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ABSTRACT

This guide is designed to provide additional resources for technology educators who are attempting to shift their programs from industrial arts to technology education. An introduction describes the original demonstration site project, a consortium of Northeastern U.S. schools, the primary goal of which was the advancement of technological literacy. This section outlines objectives, provides a brief accounting of the major accomplishments of the individual demonstration sites, and presents a brief overview of curriculum and instruction and private business participation. The remainder of the guide is a summary of each site's activities and a description of their programs and facilities. Four demonstration projects are described: Nathaniel Hawthorne Middle School, North Colonie Schools, Ponaganset Schools, and Riverside Middle School. Following these descriptions are recommendations from the four projects. The final section of the guide contains some of the Technology Learning Activities used and developed during the project. Representative topics include the following: tractor pull, wind powered cars, metrics, robotics, developing and communicating ideas, design, satellite communications, ping pong cannon, and foam planes. Appendixes include two articles, "Understanding the Change Process" (Tad Foster) and "The Northeast Technology Education Consortium" (Robert Nannay et al.). (YLB)

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Northeast Technology Education Consortium: Resource Guide

Central Connecticut State University
Department of Technology Education
New Britain, CT 06050

1994

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PREFACE

This guide was developed to provide additional resources for technology educators who are attempting to transition their programs from industrial arts to technology education. By no means is this document a complete guide for this transition. Instead, it is a brief discussion of how four programs made the transition with help from many sources.

The original project described in this guide was a demonstration site project funded by the U. S. Department of Education for 18 months during 1991 and 1992. The U. S. Department of Education is in no way connected to this document. In addition, the information contained in this guide is a description by the authors and editor and does not reflect the opinions or policy of the Technical Foundation of America.

It should be noted that any Technology teachers interested in transitioning their programs from industrial arts to Technology Education will need to do so within the guidelines provided by their state's Department of Education. The information included in this guide and others can only provide general information. Specifics about the exact nature of the T.E. curriculum and so forth should be discussed with the leaders in the state where the Technology teacher is employed.

Acknowledgments

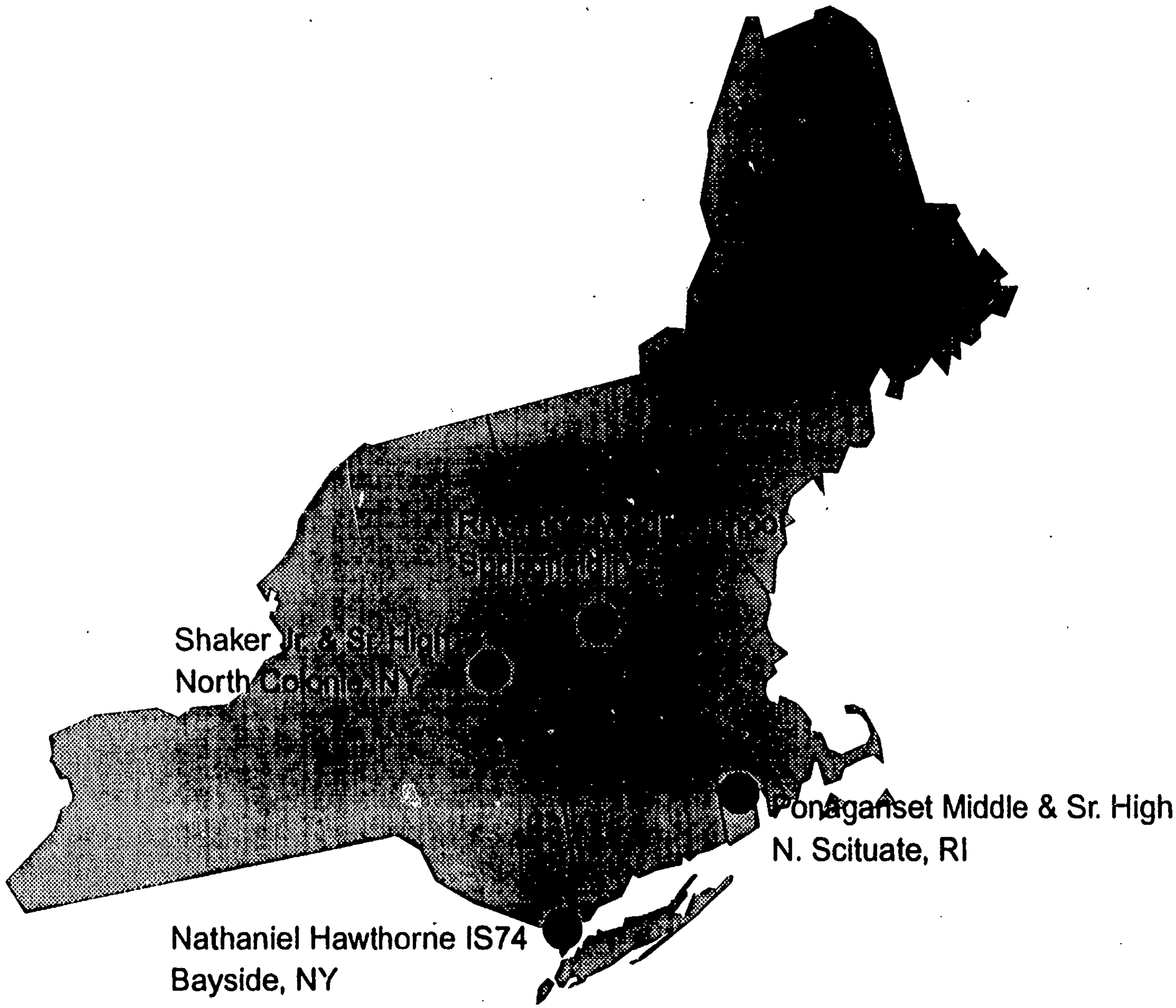
The editor and contributing authors wish to thank the Board of Trustees of the Technical Foundation of America for their willingness to fund this project which in effect allowed the continuation of the NETEC project for an additional year and resulted in a summer institute for Connecticut Technology Teachers, a resource guide for the field, and a major grant proposal to another funding agency.

The Editor acknowledges the valuable input of Dr. John Wright, Dean of the School of Technology, Central Connecticut State University and Mr. William Boudreau, NETEC Project Coordinator and retired NY Supervisor of Technology Education. This guide was made possible by their expert leadership during the NETEC Project. In addition, some of the information contained in this guide was gleaned from the final report for that project.

A special thanks to Ms. Cathleen A. McGregor-Foster for proofing the many drafts of this document.

CONTENTS

Northeast Technology Education Consortium Sites



INTRODUCTION

From January 1991 to September 1992, the U S. Department of Education funded a demonstration project in the northeast portion the United States that was known as the Northeast Technology Education Consortium (NETEC). The project involved developing five public school technology education demonstration sites with support from university faculty, state supervisors, and various businesses and industries. For the eighteen months of the project, the public school teachers and administrators were involved in curriculum development, instructional materials development, and facility redesign. University faculty and business/industry volunteers supported these sites with teacher in-service and technical expertise.

Background Information

On April 19, 1990, a group of teacher educators, state supervisors, and public school technology education teachers from throughout the Northeast met in Auburn, Massachusetts, to discuss the feasibility of responding to the U. S. Department of Education's request for proposals (RFP) to establish national Technology Education Demonstration Programs. At this meeting it was agreed that the northeast region (all six New England states plus New York State) should form a consortium that would respond to the RFP. It was also decided that Central Connecticut State University (CCSU) would represent NETEC and serve as the Project Center to manage the grant once funded.

Responsibilities were discussed and assignments made to prepare for the proposal writing task and to clearly define the purpose and goals of the proposed demonstration program concept. State supervisors agreed to work with vendors and corporations to raise private sector monies or gifts ranging from $3,000.00 to $10,000.00 each. They also worked with the state contact persons to coordinate the state approval process. The teacher educators agreed to discuss the project with their administrators and faculty to determine available resources that would be provided for the project as in-kind contributions and additionally would contact several large corporations for cash private match gifts.

The members of this newly-formed consortium agreed to establish five sites in order to provide access for teachers throughout the region to see quality technology education programs in action. The sites were located in New York City, up-state New York, Southern Vermont, Southern Maine, and Northwestern Rhode Island.

Goals and Objectives

The primary goal of the NETEC project was the advancement of technological literacy. The primary vehicle chosen to achieve this goal was the development of five public school technology education programs (regional project sites) and one university-based Project Center in the Northeast. The project sites served as models of the transition of existing industrial arts programs into technology education programs.

The five sites were selected based on their progress toward becoming technology education programs, the quality of those programs, the willingness of the teachers to share ideas, the commitment of their administration to provide additional local resources, and the willingness to allow open access for visitations. Further, they agreed to emphasize the inter-relationships of math/science/technology. The sites were geographically located in sections of the northeast to facilitate accessibility. Finally, these sites provide a mix of inner city, rural, small suburban, and large suburban technology education programs.

The NETEC Project Center, located at Central Connecticut State University, managed the grant, coordinated the resources, and provided curricula assistance to the public school demonstration programs. The Center also engaged in research, development, and collection of technology education curriculum materials for dissemination to NETEC sister institutions, the public school demonstration programs, and (upon request) other technology teachers in the Northeast. The NETEC Project Center also provided multi-disciplinary workshops at Central Connecticut State University to emphasize the need to integrate mathematics, science, and technology education. On a regular basis, faculty from the NETEC member institutions, graduate assistants from the Center, and the Director provided regular and continuing on-site assistance to ensure the quality and success of the five demonstration programs.

Specifically, the objectives of the project were as follows:

1. To develop, enhance, and support model technology education programs at five regional public school demonstration sites in the northeastern United States.
2. To establish a NETEC Project Center at Central Connecticut State University to manage the demonstration sites, provide in-service education, curriculum development, instructional designs, and collection/dissemination of technology education resources.
3. To conduct a summer institute for demonstration program teachers to develop and/or enhance teacher capability in:
   a. Content refinement in construction, communication, manufacturing, and transportation technologies.
   b. Understanding the impacts of technology on society.
   c. Alternative instructional strategies for technology education.
   d. Teaching mathematics and science concepts through student activities in technology education.
   e. Using design briefs to set up problem solving experiences for students.
   f. Developing alternative evaluation and assessment techniques for technology education.
4. To provide information and publications concerning the demonstration programs to all technology education teachers in New York, Vermont, New Hampshire, Maine, Massachusetts, Rhode Island, and Connecticut, and eventually nationwide for the purpose of motivating them to visit a model program.
5. To pool the capital and human resources of technology teacher education programs, State Departments of Education, local education agencies, and regional business and industry along with the resources from the grant to create and support a quality Northeast Technology Education Demonstration program.

Major Accomplishments

The NETEC project has demonstrated that business and industry and educational agencies can work together to improve programs and enhance learning. Donations by business and industry to the five demonstration sites were extraordinary (over $900,000). These resources were divided equally among the sites. There were problems in facilitating the money transfers from the management site to the demonstration sites because of bureaucratic red tape and there were problems in arranging common and mutually agreeable times and locations for meetings, workshops and institutes, but all problems were resolved. The major ingredient that made NETEC work was the desire to cooperate.

A brief accounting of the major accomplishments of the individual demonstration sites follows.

Nathaniel Hawthorne IS 74 - Dramatic laboratory improvement (one laboratory was transformed from a ceramics shop to a very modern and up-to-date communications laboratory). The three technology teachers have assumed a leadership position within the school and among their colleagues in the whole City District which includes over 100 high schools and over 200 middle schools. This was accomplished through cooperative instructional planning among the technology education staff.

North Colonie - Major facility modification, review and refinement of an already well-developed technology education curriculum, upgrading of teacher skills, increased support from other disciplines within the school, and a more global approach to technology education.

Ponaganset - Increased benefit from the general building project at both schools, major laboratory improvement, change from traditional programs, and major improvement in teacher attitude and skills with cutting-edge equipment.

Riverside Junior High School - Complete modification of the one large laboratory (all resources were concentrated on the only laboratory in the school), leadership within Vermont, tremendous professional growth in an already excellent teacher, proof that with the correct attitude one teacher can accomplish a great deal.

South Portland High School - Demonstrated the flexibility of the project design by following a different plan from the other four sites. For example, they immediately formed an advisory committee to help plan for and raise funding ($1.5 M) to renovate the technology education facilities. (Note: Due to a change in teachers at this program, it is not possible to report on the final outcomes for this site. It was also not possible to include the South Portland site in this resource guide).

As indicated earlier, all major objectives were accomplished in the five sites by each one determining their own needs at the project's inception and then setting out to accomplish them based on their own assessment and that of the management staff at CCSU. The process worked very well.

Curriculum and Instruction

The teachers and administrators at the five sites were encouraged to ensure that their content organizers agreed with the national thrust in technology education (i.e., construction, communication, manufacturing, and transportation). There was considerable discussion as to whether biotechnology should be a separate organizer or subsumed under one or more of the other organizers. The exact placement of biotechnology was not of much interest to site teachers but they believed that it should be part of the curriculum.

The learning activities used and developed emphasized the impacts of technology, alternative instructional strategies like teaming with teachers of different subject specialties, and the integration of mathematics and science with technology. The ability to best use design briefs in problem solving activities was extensively discussed and practiced. Although all sites are to some degree bound by state and local district mandates, most of the teachers were able to try alternative assessment procedures as a result of the interaction with each other.

In looking at the four states in which the sites are located, one of the most important observations the coordinator made was that the programs were much more similar than dissimilar and, in general, the teachers and administrators agreed on major content decisions.

Private Business Participation

This project has been an example of very positive relationships between private business, government, and education. Equipment and services, donated by private businesses to the five sites has totaled in excess of $900,000.00. This, along with the $295,270.00 in federal grant money, made it possible to provide in excess of $150,000.00 in supplies, equipment, hardware, software, and services to each site. In short, this effort resulted in an unheard of amount of resources for any individual program over a two-year period.

For the duration of the project, the five demonstration sites provided (and continue to provide) examples of quality technology education programs for those interested in making the transition from industrial arts to technology education. As you will see in the summaries that follow this introduction, the members of the consortium are convinced that this project provided the impetus needed to speed up their own transition process.

This in itself is enough to indicate that the project was a success. However the impact of the project goes much further. It has had and continues to have a strong influence on many other programs in the northeast.

The Future of NETEC

The NETEC project officially ended on September 30, 1992. However, the members of the consortium felt that their work was not finished. They still continue to open their laboratories to interested parties. In addition, with the assistance of Dr. W. Tad Foster (the new Chair of Technology Education at CCSU as of January 1, 1993), a grant proposal was submitted to the Technical Foundation of America to support a summer institute for Connecticut technology education teachers, and the development of this resource guide. Additional grant proposals have been submitted to support regional teacher development activities focusing on the integration of mathematics, science, and technology.

The remainder of this document is a summary of each sites activities and a description of their programs and facilities. In addition, some of the Technology Learning Activities used and developed during the project are provided. Finally, information is provided to help the reader understand and manage the change process better (See Appendix A).

Nathaniel Hawthorne Intermediate School, IS#74

Mitch Kittenplan, Technology Teacher

Eric Steinberg, Technology Teacher

Frank Bargione, Technology Teacher

61-15 Oceania Street
Bayside, NY 11364

OVERVIEW

Welcome to Technology at Nathaniel Hawthorne Intermediate School.

We are one of the five NETEC sites serving as a demonstration school for Technology Education. Individually we are three technology teachers who came up through the ranks as industrial arts teachers, based in single-unit shops. We've attempted to change our focus while transforming our physical plant into technology labs. It is an evolutionary change that is still taking place.

Our school is located in an urban middle class neighborhood embracing students of near poverty to upper middle class levels. The ethnic population is a veritable United Nations, with students of virtually all nationalities, races, and religions. In recent years, there has been an influx of Asian-American students. The total student population, including Special Education, exceeds nine hundred. Nathaniel Hawthorne enrolls students in grades sixth through eighth.

In this section, you will learn about a variety of technology activities, ideas and equipment. We hope to assist you in visualizing what technology is or can be.

SAMPLE

Press Release | For Immediate Release

"Technology Literacy Project Selects Nathaniel Hawthorne Intermediate School as National Demonstration Site"

The United States Office of Education has funded a project to establish five national demonstration programs in Technology Education. Nathaniel Hawthorne Intermediate School 74 has been selected as one of five schools in the Northeast to provide a program that will improve the technological literacy of students through innovative technology based education.

The project is managed by Central Connecticut State University who formed the Northeast Technology Education Consortium (NETEC) made up of the six New England states and New York. Eight major Universities who prepare Technology Education teachers will provide assistance and resources to five public school sites where other teachers can visit and see quality Technology Education in action.

The primary goal of the project is to demonstrate the interface of mathematics, science and technology through unique problem solving, action based instruction, and activity. Students will also gain knowledge about the technological systems of production, communication, transportation, and bio-related technologies, including an international perspective and technological impact appreciation.

The project is funded by the United States Office of education with matching private sector funds from over 25 industrial companies. In service and curriculum development activities are provided by the NETEC Universities at no cost to the school district. The anticipated length of the project is two years.

Participating in the project will be Frank Bargione, Mitch Kittenplan and Eric Steinberg. I.S. 74 was selected because of its contemporary approach to Technology Education and its commitment to excellence in the classroom. Morton Kugal is the supervisor of the Technology Education Department. Michael W. Shyman is the Principal.

THE CHANGE PROCESS

The conversion from industrial arts to technology education at Nathaniel Hawthorne Intermediate School can be traced back to the germination of the N.E.T.E.C. project in the spring of 1990. Even with a model program in place today, changes are still taking place and will continue to take place in the future.

The renovations to the program began with renovations to the physical plant. However, no work was actually started until intensive planning for the change took place. Designs were drafted, reviewed and continuously revised. The primary goals for the rooms were to maximize space and to create a new and dynamic look. The ceramics shop was completely gutted. The room was repainted, trimmed and carpeted. New benches, technology islands, and work stations were built and installed. New equipment and computers were brought in to teach communication technology.

The woodworking shop was painted and trimmed and carpeting was installed around the technology islands. Wardrobe closets were removed, and icons were painted on the walls. Eight of the twelve woodworking benches were removed and two new technology islands were constructed in their place. Most of the woodworking equipment was removed, replaced by equipment to teach production and business enterprise. Additionally, the oversized storage room attached to the woodworking shop was divided into three sections. It created a new Technology Store, a new Technology Department office and a smaller storage area. Each of these sections was repainted, furnished appropriately and additional lighting was installed.

The metal shop was repainted and trimmed, and carpeting was installed in one area. Some duplicate machines were removed, benches were built and either painted or covered with formica. Additional equipment was added to teach transportation, power, construction, and energy. All of the rooms had electrical upgrading and new student furniture was added.

The end result of this renovation was a ceramic shop completely changed into a new communications technology lab. The woodworking shop was altered by approximately three-quarters in transforming it into the production and business lab. The metal shop was changed less than either of the other two shops. Roughly one-half of the room was modified into the new transportation, power, construction, and energy lab.

It should be pointed out that many, if not most, schools offer only general technology labs at the middle school level. In that scenario, each of the school's general labs are relatively the same, with the curriculum changed based on the grade level taught. Hawthorne Technology was developed with a different approach in mind. Each of the teachers brought a distinct specialty to technology education. This expertise was further enhanced by nearly seventy five years of combined pedagogical experience. With that in mind, three distinct areas of technology education were embodied in these labs. Each teacher was free to design a lab to meet the needs of his curriculum specialty, a curriculum that could be developed, modified, and expanded. Departmental brainstorming was also an integral part of both the lab and curriculum design. This interaction of the technology education team was crucial to the success of the program.

PRO's and CON's

The changes in the Hawthorne technology program have brought about outcomes that were both positive and negative. These outcomes are outlined below:

Positive Outcomes

- Revitalization of the program.
- Boosted student interest.
- Increased emphasis on problem solving.
- Integration of technology education curriculum with math, science, and humanities.
- Use of interdisciplinary activities and projects to promote integrated education.
- Cooperation among teaching staff in relating curricula.
- Continuous evolution, evaluation and upgrading of curriculum and activities.
- Introduction of new activities.
- Ability to integrate current events into curriculum.
- Construction of a technology education office for departmental use.
- Launching of a "Technology Store" to teach practical applications of business enterprise.
- Tremendous boost in the stature of the subject area among colleagues.

Negative Outcomes

- A gargantuan amount of work involved in planning and implementing the overall change.
- Continuous work involved in planning, evaluating, integrating, and upgrading curriculum.
- Tremendous amount of extra time needed for planning.
- Time constraints create problems in finishing all proposed activities.
- Carpeting is difficult to maintain anywhere near productions areas.
- Despite attempts to address this area, "hands-on" is decreased.
- Room size is tremendous constraint.

Time Line

February 1990	C.C.N.Y. presents original proposal for participation in N.E.T.E.C.
April 1990	Dean Wright, from Central Connecticut State University visits Hawthorne to evaluate suitability of this site.
October 1990	Nathaniel Hawthorne Intermediate School is chosen as one of 5 N.E.T.E.C. sites.

January 1991	N.E.T.E.C. Conference at North Colonie, New York site. First advisory meeting with all 5 sites represented.
February 1991	Needs assessment drafted and finalized. Procured "Bridge Builder" software.
March 1991	Attended conference given by the Department of Technology of the University of South Maine and the Technology Ed. Assn. of Maine.
	Met vendors of N.E.T.E.C. equipment. Planning sessions to plan short and long term goals at Hawthorne.
	Created flow chart for the Development of Technology Education at Nathaniel Hawthorne.
	Meeting with District Superintendent and New York City Department of Technology to discuss future of the N.E.T.E.C. project.
April 1991	Took video and photographic slides of existing facility. Began accepting equipment.
May 1991	Demonstration presentation given by Technology Department of I.S. 74 at Kingsborough Community College for Technology Supervisors Conference.
	Procured donations from Hermes Engraving of Computer Assisted Engraving.
	N.E.T.E.C. Conference at Central Connecticut State University.
June 1991	Teacher training at Central Connecticut State University.
	Developed preliminary budget for N.E.T.E.C. expenses.
July/August 1991	Room expansion eliminated from initial Technology Lab plans. New plans drawn up within existing room parameters.
	New Technology Lab Islands designed.
	Color coordinated schemes picked out for all labs.
	Contact with vendors for donations outside of N.E.T.E.C.
	Contact with N.E.T.E.C. vendors
	Training at C.E.S. Industries.
	Minor structural room changes completed.
September 1991	Room rennovations promised for the start of the school year were not done.
October 1991	Room plans updated.

Rooms cleared to make way for technology. Industrial Arts benches and equipment removed or relocated.

Technology equipment taken out of storage and installed in labs.

Beginning of infusion of new Technology Learning Activities. Initial discussions with Math and Science Departments to plan out interface with Technology.

Initial planning, organization and reconfiguration of space for a new Technology Department Office.

Preliminary plans drawn up for a school Technology Store.

First visitations by C.C.S.U. Graduate Assistants.

Accepted as part of the Design and Manufacturing Technology Curriculum Project for the Middle Schools at the University of New Hampshire.

November 1991 — Initial training on equipment and computers.

Weekend training session at Central Connecticut State University.

Vendors Night for the New York City Technology Education Association.

Technology Labs painted.

Electrical needs evaluated, planned out, bid on and scheduled to be done.

Materials for technology islands purchased. Building schedule set up.

December 1991 — Technology islands constructed.

Electrical work completed.

Carpeting installed in each lab.

Training session at Central Connecticut State University.

Procured donation of a laser, multi-color copier from Konica Corporation.

January 1992 — Setting up remaining parts of the labs.

Technology Labs reopened for students.

N.E.T.E.C. Advisory Conference & visitation at Springfield, VT site.

Procured donation of Risograph printer from Copyworld.

New equipment delivered, including Macintosh Computers and peripherals for the Communication Lab obtained from Federal Magnet Grant.

Technology Department Office Painted and furnished.

February 1992	Macintosh training held at I.S. 74.
	Special curriculum writing session at C. C. S. U.
	Training session at Central Connecticut State University.
	City College of New York sends two Student Teachers.
March 1992	Hawthorne P.T.A. tours the technology labs and gives additional generous grant.
	Training session at C.C.S.U.
	Visitation by delegation from People's Republic of China.
	N.E.T.E.C. Advisory Committee meeting and visitation held at Hawthorne.
April 1992	N.E.T.E.C. Advisory Committee meeting and visitation held at North Colonie, New York site.
	Visitation at State Education Department in Albany.
	Started work on Technology Store.
	Visi. ion by delegation from Long Beach, New York.
	New York State Technology Education Association Conference in Binghamton, New York. Hawthorne Technology Department gives presentation.
	Conference to implement program for future on site State and City-wide Visitations, involving State Education Department, N.Y.C. Bureau of Technology, and C.C.N.Y.
May 1992	Visitation by delegation from Groton, Connecticut.
	N.E.T.E.C. Advisory Committee meeting and visitation at Rhode Island site.
	Ribbon-cutting ceremony to officially inaugurate the Hawthorne Technology site.

Questions About Technology Education

What is Technology?

Technology is the process we use to solve problems and extend our human capabilities. We can think of technology as knowledge and as hardware. Where do these problems come from? Problems arise from needs and wants. We need food, clothing, shelter; we want toys, games, appliances, etc. There are technological problems all around us.

What Human Capabilities Does Technology Extend?

Technology can extend our sense of sight by using microscopes, telescopes and televisions (to name just a few). It can also extend our other senses: hearing (the telephone, radio), smelling (smoke alarm), or our ability to grasp (pliers, vise, screwdriver), remember (record, tape, book, computer), and so forth.

Isn't Technology Just the Application of Science?

No. Technology and science are not the same thing. Science seeks answers to questions about the natural universe: Why do things fall? Why do they fall at a predictable rate? Why do cells mutate? Why do certain inorganic materials corrode? and many more. Science is important for our understanding of the natural world and the universe in which we live.

Technology seeks different kinds of answers because it asks very different kinds of questions: How can we communicate over long distances? How can we keep warm during winter? How can we lift a heavy load? How can we keep accurate records over time? and many more. While science seeks understanding, technology seeks solutions. Technology is important for our understanding of the human made world in which we live. Increasingly, the human made world is the one in which we find ourselves and the one impacting on our health and well being.

A review of history would seem to indicate that technology predates science by thousands of years. For example, the telescope was not invented by careful application of the science of optics. In fact, the telescope led to investigation of the behavior of light and the study of optics. There are many other examples. In today's world, however, in product research and development and in basic scientific research, science and technology are linked in a symbiotic relationship, each pushing the limits of the other, But what most people think of as science, because it is the "stuff" we can see, is actually technology.

Technology uses knowledge from all disciplines, as it would be difficult to point to any one area as more important than another. Knowledge and technique from art, design, psychology, engineering, science, history, language, mathematics and other contribute to a technological solution to a problem. Uniquely technological knowledge and technique, accumulated over thousands of years, is that which deals with the processing of materials, energy and information. This is the knowledge which satisfies our basic needs of food, clothing, shelter, and our other needs higher in the hierarchy.

What are the reasons to study technology?

There are at least three major reasons to study technology:

1. The Economic Imperative - Global competitiveness necessitates that higher numbers of our youth consider technological fields, such as product and industrial design, engineering, and a wide variety of other related careers in technology. Our future in the global marketplace (and therefore, our own economy) depends on balance of trade and having products and innovations other countries want. The results of technology are the products and services we consume and export around the world. Our people and their ideas are valuable national resources.

2. Its Intrinsic Value - There is educational relevance in the study of technology because it is process-based (design and problem solving), and it is sound educational practice (Dewey's

"reflective thinking"). Because technology is central to our society, authentic problems bring the "real world" into the classroom. Technology, in addition to having its own content and processes, involves knowledge and skills from all areas of human knowledge. It can bring together knowledge from these different subject areas in a meaningful way.

3. For Citizenship - Environmental Imperative: the health of our planet and ourselves. To be able to understand and use technology in our lives. Technologically capable/literate citizens are better able to make decisions about the use and misuse of technology.

What are the goals of Hawthorne's technology program?

The Commission on Technology Education for the State of New Jersey published these nine goals in 1987. This list was adopted to provide guidance for the changes at Hawthorne.

1. To develop within students an understanding of the impacts and consequences of technology so that, as citizens they can exercise some control over these developments as well as recognize the needs and desirability of technological developments.
2. To develop an understanding of technological systems as related to resources, processes, and outputs of these systems.
3. To apply creative problem-solving techniques to the solution of technological problems.
4. To engage students from all sectors of society in meaningful, first hand experiences with technology.
5. To apply the concepts of mathematics, science, social studies, and the arts in the content of contemporary technology.
6. To use technology as catalyst for an interdisciplinary approach to education.
7. To help all students make informed career choices.
8. To help all students make decisions as users of technology.
9. To develop an attitude that encourages students, as individuals, to keep pace with a rapidly changing society and to realize that education is a life-long process.

Technology Education Instructional Components at Hawthorne

- describe and define technologies.
- know the development history of technologies.
- know the uses of various technologies.
- understand how technology systems and sub-systems operate.
- know the impact of technologies on us and our environment.
- know the skills needed to design technology systems.
- be aware of the career opportunities of each technology.

Short Term Goals for Hawthorne

1. Establish 3 technology labs from 3 single unit shops.

2. New ergonomically designed and laid out labs with architectural assistance.
3. The construction and expansion of the labs and relocation of equipment.
4. Set up new equipment.
5. Continue to phase in the New York State Technology Curriculum.
6. Training in new technologies and new approaches in teaching.
7. Phasing in interdisciplinary connections to math, science and humanities.
8. Begin to develop technological literacy in our students.
9. Use technology to begin facilitating the conversion to the Middle School concept.
10. Provide information to the community about technology education and specifically, our program.
11. Instill an awareness in our faculty of technology education and its relationship to all subject areas.
12. Begin to develop multi-media material (i.e., charts, photos, video, etc.).

Long Term Goals for Hawthorne

1. Develop technological awareness in our students, our faculty and our community.
2. Apply technology as a catalyst in converting to the Middle School concept.
3. Full integration of technology with classroom work in math, science and humanities.
4. Develop a model program in technology for New York City.
5. Assume a leadership role in technology education for New York City.
6. Develop a guide to facilitate the establishment of Technology Labs. This guide can be given out to visitors to our program.
7. Develop a multi-media presentation showcasing our program.
8. Develop an interdisciplinary approach to technology curriculum within our three unique technology labs. This approach will cover all New York State Technology modules by the sum of the three courses. Some overlapping of these modules, with different emphasis, will exist in the areas of Transportation, Communication and Production.

CURRICULUM

Approximately 90% of the 6 - 8 th graders attending Nathaniel Hawthorne Intermediate School take technology education. The remaining 10% are enrolled in an Art or Music sequence because of their talent and interest. Once enrolled in technology education, the technology teachers divide the students into groups. Each group then spends that year with one of the three teachers. The technology classes meet twice per week (45 minute periods) for the entire year. By the end of three years, each student will have had class with each of the teachers and would have progressed through three technology courses. The following is a description of each course:

Communication Technology

Course Outline

Historical Background

- Development of Communications
- Time Line
- Math/Science Interface

Data

- Electrical Theory
- Electricity/Electronic Trainers
- Telegraph
- FAX
- Modems
- Computers
- Math/Science Interface

Technical Design

- Playground Construction
- CAD/CAM
- Mechanical Drawing
- Logo Design
- Package Design
- Math/Science Interface

Optics

- Fiber Optics
- Photographic Imaging
- Holography
- Lasers
- Periscope
- Math/Science Interface

Graphic Production

- Desktop Publishing
- Silkscreen Design
- Advertising Design
- Typography
- Layout and Design Concepts
- Cookbook
- Math/Science Interface

Audio & Video

- Video Production
- Satellite Communication
- Telegraph
- Multi-Media Presentation
- Math/Science Interface

Communication Technology
Instructional Activities

- *Playground*
- *Inventions*
- *Optical Fiber*
  - General
  - Morse Code
- *Morse & Broadcasting*
  - Old Commercials
  - Trip to Newsday
  - Trip to Cablevision
  - Production Marketing
  - Audio Commercial
  - Satellite Transmission
  - Video Commercial
  - Packaging
  - Newspaper Ads
  - Bumper Sticker
- *Satellite Transmission (background)*
  - Globe Mockup with Mirrors
- *Desktop Publishing*
  - Stationary
  - Business CArds
  - Flyers
  - Newspapers
  - Newsletters
  - PrintShop
  - Introduction
  - Advertising Design & Re-Design
  - Logo
  - Pictograph
  - Icon
  - Mechanical Drawing
  - Sketch
  - Isometric
  - Perspective
  - Orthographic
- *Product Testing- Newsletter*
- *Electricity*
  - Battery Holder
  - Conductivity Tester
  - Quiz Board
  - Touchdown
  - Membrane Panel Switch
  - Electromagnet
  - Electromagnet & Sound Waves
  - CES Trainer
- *Heat Transfer & Silk Screen*
- *Sim City*
- *Making Paper*
- *Carved Rubber Stamp*
- *Binding*
- *Paper and Ink Collection*
- *School News Broadcast*
- *Photography Contest*
- *Printing Company*
- *Future Scenarios*
- *Time Line*

Manufacturing & Business Enterprise Technology

Course Outline

Historical Background

What is technology? ..Human Needs?.. Implementation of Innovation from Basic Idea to Modern Technological Development.

Technology Learning Activities:

Bucksaw	Time Line
Spinning Top	Math/Science Interface
Tic Tac Toe	Library Interface

Production Systems

Understanding the concepts of systems and sub-systems in the use of mass production and manufacturing.

Technology Learning Activities:

Plastic Injection	Hydroponics
Slip Casting	Lego- Basics, Battery
Computerized Engraving	Operated
Computerized Lathe	Math/Science Interface
Computerized Lego	Library
Silkscreening Party	

Business Enterprise

Taking the student from an idea stage through all of the steps required in establishing a small business.

Technology Learning Activities:

Problem solving	Record Keeping and Retrieval
Leadership	Corporate Set-up
Quality Assurance	Management Structure
Distribution	Design
Cash Flow	Math/Science Interface

Transportation, Construction, Energy and Power Technology

Course Outline

Historical Background

Time Line :Transportation, construction, energy and power

Transportation Systems - Moving people and Materials

Land: Escalators, elevators, conveyor belts, wheels, tracks

MagLev, and overhead cables

Water: Immersible, submersible, hovercraft, canals & locks

Air: Gliders, planes, balloons, dirigibles, and helicopters

Space: Rockets

Additional Topics: Propulsion systems, math/scienceinterface

environmental, social and economic effect of certain types of technology

Construction:

Shelters: Houses and buildings

Structures: Industrial, bridges, and skyscrapers

Transportation: Tracks, roads, tunnels, and highways

Additional Topics: Math/science interface, energy and environmental impacts

Energy Conversion Systems

Kinds of Energy: Renewable, non-renewable, potential, kinetic, solar, gravity, geothermal, wind, wave action, tides and fossil fuels

Energy Conversion to Mechanical or Electrical: Propulsion systems, review electric power, electrical transmission systems and transformer

Mechanical Transmission Systems: Gears, cams, hydraulics, pneumatics, chains, drive belts, friction drives

Additional Topics: Math/science interface, environmental

Impacts

Systems:

Open loop system

Closed loop system

Feedback and controls

Sensors

Math/Science Interface

Environmental Impacts

North Colonie Central Schools

Shaker Middle & High School

Thomas Venezio, Technology Supervisor

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Latham, NY 12110

26

OVERVIEW

School and Community

The North Colonie Central School District is located in a largely residential, suburban area six miles north of Albany, New York. The community's socio-economic composition is primarily middle class. The district has one high school, one junior high school and six elementary schools with an approximate enrollment total of 5000 students.

Shaker Junior High School houses grades 7 and 8 and has an approximate enrollment of 800 students. There are three technology education labs and 3.8 technology education teachers. The New York State curriculum, Introduction to Technology, has been delivered since 1986.

Shaker High School has an enrollment of approximately 1600 students in grades 9-12. Typically over 85% of the students in a graduating class pursue further education. There are six technology education labs and four full-time technology education teachers. Twenty different elective courses are available to students in technology education and can be taken as individual courses or as part of a three or five unit sequence. Two of these courses are full year courses with the remaining being half year, one semester courses.

THE CHANGE PROCESS

The process of making major change in an educational program is never easy. It requires a high degree of commitment on the part of teachers and administrators and the patience to see the process through to completion. In North Colonie, teachers and administrators saw the need to upgrade and improve, however, it took time for everyone to become comfortable with the proposed changes. This time, approximately six months, is critical to the process. If faculty members don't have time to become familiar and comfortable with the proposal, they won't support it!

The school district also made a commitment by providing paid time for every faculty member to come in during the summer to write curriculum. At the time, all eight faculty members were paid for five days of summer curriculum writing. Following the New York State Curriculum guides for all of the courses, however, teachers used this time to develop specific lesson and activity materials. It is also important to note that the entire junior high school curriculum was replaced. At the high school level, several old courses were replaced with new ones and several courses were significantly revised.

The facilities had changed very little initially with general industrial arts shops at the junior high and industrial arts unit shops at the high school. Slowly as new activities developed facilities began to take on a new look.

The faculty in North Colonie have worked hard to make the changes needed to keep their program up-to-date and meaningful for their students. This is a process that has taken eight years and is still not complete. Not only isn't the process complete now, it probably will never be. Rapid technological change necessitate the ability to make continual adjustments in our programs. Fortunately, once the major program changes take place, it becomes easier to make these "mid course corrections." It is also important to note that this process of change has created an enthusiasm and camaraderie on the part of the faculty that makes these minor changes, adjustments and improvements painless.

Technology Education in North Colonie Prior to the NETEC Project

In 1986, a mandate was established by the Board of Regents that required one unit of Technology Education for every student in New York State between grades 7 & 8. North Colonie complied with this mandate and developed a strong technology education program at the junior high school. In addition, a complete revision of all high school courses was completed. Teachers at both the junior and senior high school levels were provided with summer curriculum development time to construct and revise all of these curriculum documents.

Over the period of the next 4-5 years, North Colonie's program grew and developed a strong reputation as an excellent example of technology education in action. Faculty members attended many conferences and workshops as presenters and also as eager learners. During this time period, the New York State Education Department frequently brought state, national, and international visitors through North Colonie's program as an example of the power of technology education.

During NETEC

The NETEC Project helped North Colonie bring technology education to the next important level. To this point, little had been done with regard to facilities. NETEC provided the impetus for North Colonie's faculty to give serious thought to facility improvement and renovation. As the project unfolded faculty members invested a great deal of their personal time to re-design facilities, clean out junk, and paint rooms. Donated equipment added the crowning glory to this fine effort.

The NETEC Project also provided a valuable opportunity for the North Colonie faculty to work with teachers from other NETEC sites and exchange ideas, materials, and plans and also develop an ongoing rapport and dialogue. Above all, the NETEC Project provided a level of enthusiasm that has continued well after the grant ended.

Goals Related to the NETEC Grant.

1. Greater articulation will occur with science.
   - Joint meetings will be held between departments to familiarize each other with our respective curriculum.
   - Math and science concepts will be clearly stated in all technology education curriculum documents.
   - The Department Supervisor will continue to serve on the District Science Steering Committee.
2. All laboratories will be cleaned up and reorganized with an emphasis on overall improvement of appearance and functionality. Additionally, one or two labs may be significantly remodeled.
3. A continued emphasis will be placed on introducing new, "high tech" activities in all courses. Appropriate in-service training will be arranged when needed.
4. A continuing, but increased effort will be made to attract girls into the high school technology education program.
5. A continuing, but increased effort will be made to gain business and industry input into the technology education program.
   - Increase participation in the Occupational Advisory Council.
   - Continue the dialogue and work with the Schenectady Employment Training Development Corporation.
   - Increase participation of guest speakers from industry in classes.
   - Develop a dialogue with the Eastern N.Y. Technical Council.
6. Maintain an aggressive public relation effort.
7. Prepare for and arrange facility tours for visiting educators.
   - Develop and prepare a packet of descriptive materials.
   - Develop a schedule for visitations.
8. Coordinate with organizations providing in-service training and make the North Colonie facilities available as appropriate.

Staff Development

This is a major component of the change from industrial arts to technology education that requires a significant commitment on the part of the school district. In North Colonie, teachers were encouraged to participate in in-service courses and workshops and were paid for in-service credit as defined by the teachers contract. They were also encouraged to attend conferences and were provided with release time from their teaching responsibilities to attend these conferences. Faculty participated in regional in-service training provided by New York State during the period from 1986-90. Faculty members also served as trainers and coordinators in these efforts at various times. The NETEC project also provided an opportunity for teachers to visit Central Connecticut State University on several occasions to attend workshops. These workshops were helpful in learning how to use new equipment and, more importantly, how to infuse these activities into the curriculum.

Staff development continues to be an important focus for all faculty members. Every year, teachers continue to attend conferences, workshops and utilize district staff development days to enhance their knowledge and skills.

Technology Education - Reactions

Technology Education continues to ride a wave of strong success and positive reaction. In addition to increasing enrollments at the high school and junior high school levels, there are a variety of important initiatives underway that involve Technology Education. These include:

- an effort to introduce technology education at the elementary level to enhance math and science. (Technology teachers conducted workshops for all elementary teachers on problem solving and simple machines. The Department Supervisor's position has now been expanded to include K-6 responsibility.)
- the introduction of two new courses and the addition of one faculty position, in spite of tight district budgets.
- a plan to develop a high school math, science & technology course that would be team taught with teachers from all three areas.

Technology Education is viewed as an important component of all children's general education in the North Colonie Central School. The teachers are viewed as experts in teaching problem solving and critical thinking. As a result, the program enjoys great support from all administrative levels, the school, and the community.

Time Line

May 1990	Troy Record article announcing North Colonie's participation in grant application
September 1990	Department Supervisor appointed to District Science Steering Committee
October 1990	Developed and submitted a Summer Curriculum Workshop proposal
November 1990	Met with Bill Boudreau, NETEC Project Director, and all department members to discuss needs and goals
	Articles in the Troy Record, Colonie Spotlight, and the Times Union
December 1990	Development of a visitation packet
	Identification of machines to be sold as surplus equipment
	Began clean-up of labs
	Advisory Board meeting at CCSU
January 1991	Hosted Advisory Board meeting in North Colonie
February 1991	Received donations from Delmar Publishers, MFASCO and Catskill Mt. Lumber
	Met with department members to discuss needs assessment
March 1991	Advisory Board meeting in Maine
	Floor plan of D122 at Shaker Junior High submitted to Kaestle Boos
	Meeting held with the Shaker Junior High Science Department
April 1991	Meeting held with Mike Hacker, NY Supervisor for Technology Education, and several department members to discuss the needs assessment and facilities
	Finalize needs assessment
	Completed goals for the project
	Received donations from Light Machines, and CES
May 1991	Advisory Board meeting at CCSU
	On-site training by CES
	Began use of CES Satellite and Electronics Trainer
	Received donation from the Construction Estimator
	Slide presentation developed regarding NETEC and North Colonie
	Presentation about NETEC by Bill Boudreau and Tom Venezio at the NYSTEA Conference
June 1991	Received PaxComm Satellite, Aldus Pagemaker, Lego Technic Kits
	Made presentation regarding the NETEC grant to the Suburban Council Superintendents and the North Colonie School Board

	In-service Workshop attended by all staff at CCSU
	Visit by U. S. Office of Education Staff
	Visit by Jonas Borjesan, Lego Dacta
	Revision of all curriculum documents to better reflect the mathematics, science, technology interface
July 1991	Renovation of junior high finishing room and conversion into a computer room
	Receipt of Digital computers, Pitsco and NIDA donations
September 1991	Substantial improvements in all labs (cleaning, painting, re-organization)
	Received Kelvin donations
	Introduced CES Satellite and Lego Technic II at grades 4 and 5 to support social studies and mathematics
	Presentation of NETEC School Plaques at Board of Education meeting
	Establishment of a Science and Technology Sub-Committee as part of the District Science Steering Committee
October 1991	Attended NETEC Advisory Board Meeting at CCSU
	Assisted the high school Mathematics Department with revision of their computer science course
	Revision of the Shaker High Science Specialized Diploma to include technology education courses
	Presentation and sharing of activities and curriculum materials at North Country Educational Consortium Workshop (Massena)
November 1991	Weekend workshop at CCSU (in-service training for all faculty)
	Assistance provided by C CSU graduate assistants
	Visit to program by Chief Counsel and Director of the NYS Legislative Commission on Science and Technology and the Assistant Secretary to the Governor Workshop for district elementary teachers regarding Technology Education
	NIDA and Cadkey equipment received
December 1991	Participation in teleconference by New Jersey SED and the New Jersey Network regarding technology education
	NETEC Advisory Board meeting

CURRICULUM

As noted earlier, courses taught in North Colonie are based on the New York State Syllabi. These documents, however, are not specific with regard to instructional activities and detailed content. Individual teachers were given the opportunity during paid summer curriculum time to put "the meat on the bones."

Shaker Junior High School

Students attending Shaker Junior High School are required by the state to complete 1 unit of instruction in technology. Bascially, this means that every student is enrolled for one semester during the seventh and eighth grades. The following is a listing of the ten modules of the Introduction to Technology course; the goal for each module as prescribed by the State Education Department; and several sample activities used at Shaker Junior High School. The topics listed in parenthesis after each activity represent the math and Science concepts to be taught or referenced.

MODULE T-1: Getting To Know Technology

Goal - In this module the student will examine the historical evolution of technological innovation as a means through which human needs and wants are satisfied.

Technology Learning Activities

- Production of a tool or implement representative of a particular historical age - for example: bucksaw, candle sconce, mallet, spoon (wood cell structure/strength, measurement, scale drawings).
- Production of a screwdriver using the computer numeric controlled lathe (coordinates, temp./friction).
- Production of an injection molded screwdriver (viscosity, temp. measurement).

MODULE T-2: What Resources Are Needed For Technology

Goal - In this module students will explore and use the seven basic resources which are necessary for technology.

Technology Learning Activities

- Design and drawing of a logo related to the resources for technology (use of geometric shapes, measurement, scales)
- Material testing (experimentation/testing, measurement, levers, cellular structure of wood/density, torque, types of strength, thermoplastic/thermosetting, adhesion).

MODULE T-3: How People Use Technology to Solve Problems

Goal - In this module students will explore and experience how people can solve technological problems by using a formalized problem solving "system."

Technology Learning Activities - Several different problem solving activities are used to teach this module, including:

- Rubber band powered vehicles (ratios, friction, potential kinetic energy, measurement, inertia/momentum).
- Wind powered vehicles (friction, area measurement, levers, measurement, averages).
- A catapult (levers, friction, measurement).
- Bridge building (torque, geometry, adhesion, levers, shear).

MODULE T-4: Systems and Subsystems

Goal - This module is designed to provide students with an introduction to the structure, function, components, and control of technological systems. Through a study of generic systems concepts, students will gain an understanding of the similarities that exist among physical, information/communication, and biologically related technological systems.

Technology Learning Activities

- Model rocket construction - (Newton's Laws, fuels, trigonometry, graphs, electrical resistance, electric circuits, aerodynamics, weather).

MODULE T-5: How Technology Affects People and the Environment

Goal - This module is designed to provide students with an understanding of the positive and negative impacts of technology. It should instill the perception that people must assume the responsibility for adapting technology to the environment and to the human user.

Technology Learning Activities

- Beach chair design - cardboard (scaling, cellular structures, biology, statistics, ergonomics).

MODULE T-6: Choosing Appropriate Resources for Technological Systems

Goal - This module is designed to teach students to choose resources from each of the resource categories based upon a set of criteria, such as cost, safety, availability, and other consideration. To accomplish this, students will apply the knowledge gained about resources in Module T-2 to the selection of those resources considered most appropriate for use within selected biologically related, information/communication, and physical technology systems.

Technology Learning Activities

- Development of a prototype and sales presentation including a videotape. Products developed have included: - Coin storage devices (cost (decimal) calculation, measurement, material properties); Educational games (material properties, toxicity (biology)); Clothes hanger (torque, material properties, levers, decimal calculatio); Extension cord holder (torque, material properties, levers, decimal calculation).

MODULE T-7: How Resources are Processed by Technological Systems

Goal - This module will show students how resources are processed by technological systems which people use to meet human wants and needs and to solve problems. Students will experience the conversion of energy, information, and materials from one form to another through processes involving humans (and their knowledge), capital, tools, machines, and time. Conversion processes in physical technologies, biologically related and information/communication technologies will be demonstrated.

Technology Learning Activities

- Develop a process for transmitting a message non-verbally (wave length of sound, speed of light, speed of electrons, counting, levers, reflection, simple machines, radio frequency).
- Students research, demonstrate, and write a report related to processing of materials (properties of materials, energy types, electroplating).
- Design & development electrical circuits (all aspects of basic electricity).

MODULE T-8: Controlling Technological Systems

Goal - This module is designed to provide students with an understanding of how technological systems are controlled. Students will learn that systems in biologically related, information/communication, and physical technologies can be governed by feedback control (closed loop) sub-systems and/or open loop control sub-systems such as a timers or computer programs.

Technology Learning Activities

- Self-guided students activities including:
  - Robotics (programming, measurement)
  - CNC (solid geometry, coordinates)
  - Computer graphics (solid geometry, coordinates)
  - Brain train
- Electricity activities including a bell/buzzer activity (electromagnetism, levers).
- Maglev Car designed on CAD and built in lab (distance measurement, scaling, aerodynamics, ergonomics, optics, time measurement, magnetism).
- Circuit tester activity (electricity, specifically continuity, resistance, series circuits, melting temperatures).

MODULE T-9: Social Impacts of Technology

Goal - This module is designed to provide students with an understanding of the social factors involved in making decisions about the selection and use of technological systems. Students will learn to assess a technological system in terms of social as well as environmental impacts.

MODULE T-10: Using Systems to Solve Problems

Goal - The goal of this module is to provide the students with an understanding of the way in which their knowledge of systems can be put to use in solving problems in aspects of biologically related technology, information/communication technology and physical technology . In addition, students will learn how to combine various sub-systems to provide integrated solutions to various realistic problems or challenges.

Technology Learning Activities - Problem solving activities including:

- Bridge construction (torque, geometry, adhesion, levers, shear).
- Water detector (buoyancy, electricity, surface tension and conductivity of water, levers).
- $C0_2$ Car (friction, energy, aerodynamics, time measurement, chemistry ($C0_2$ gas), distance measurement, relative acceleration).

Shaker High School

All Technology courses continue to emphasize important occupational and life skills taught through the use of "hands-on" project work. No prerequisites exist for any courses. It should also be noted that any course marked with asterisk (*) may be used toward the fulfillment of the required one-unit of Art credit by students pursuing an Occupational Education sequence. This description of high school courses should provide a general sense of the content and activities included in each. It should also be noted that students taking Communications Systems, Production Systems, and Transportation Systems are required to pass a State examination in these respective courses. This, of course, makes it essential to deliver the content outlined in the New York State Curriculum guides. In addition students graduating from a NY high school must specialize in either two 3-unit sequences or one 5-unit sequence in an area of interest.

<u>Three Unit Technology Sequence Requirements:</u>

Introduction to Technology Occupations	1/2 unit
One Course from Group I	1/2 unit
Two Courses from Group II	1 unit
Two Courses from Group III	1 unit

<u>Five Unit Sequence Requirements:</u>

Same as 3 unit Sequence

PLUS

4 Additional Courses from Group III

Introduction to Technology Occupations

This course is required of all students pursuing a sequence in technology. Introduction to Technology Occupations is a half year course with two required modules; The Working Citizen and Personal Resource Management. The course will help students develop transferable skills in the following areas: The working citizen module will help students explore career interests and outline procedures for obtaining a career goal. Topics include writing a resume and cover letter, interviewing, human relations, good work habits and expectations of employers. The personal resource management module will introduce the student to topics that will help them make responsible financial decisions. Topics include; balancing a check book, preparing a 1040 EZ tax form, insurance and banking. One-half unit, both semesters; New York State Proficiency Examination required.

Group I

A student desiring a Technology sequence must take one of the following 3 courses. Recommended for ninth and tenth grade students.

Production Systems

This course will focus on the two categories of production; Manufacturing and Construction. During the first ten weeks, Manufacturing will cover topics that are related to production in a factory. Topics include; company structure, manufacturing jobs, manufacturing methods, and quality control. During this time the students will participate in a small production run where each student will perform specific manufacturing tasks. During the second ten weeks the methods of construction will be covered. Topics include; footings, foundations, framing, roofing, and related construction careers. During this period students will build a model storage building. One-half unit, second semester; New York State Proficiency Examination required.

Communications Systems

This course is designed to introduce the systems approach to communicating information. Students will study many types of communication technologies such as: printing (screen printing), audio and video recording, as well as the history of communications. Each student will be instructed on the proper use of the Apple Macintosh computer and how it can be applied to the area of communications. One-half unit, second semester; New York State Proficiency Examination required.

Transportation Systems

This course is a comprehensive study of today's transportation. The course will cover transportation in three different areas: land, aerospace, and marine. Activities include, model boat building and launching, model rocket building and launching, and small engine maintenance and repair. One-half unit, first semester; New York State Proficiency Exam required.

Group II

A student desiring a Technology Sequence must take 2 of the following 3 courses. Recommended for tenth and eleventh grade students.

*Design and Drawing for Production

This is an introductory course in the area of drafting. It is an extremely beneficial course for any student seeking a Technology sequence or interested in a technical or engineering field. Topics presented will include Sketching, Problem Solving, Creativity, Design, Tools, Equipment and Materials, Lettering, Isometric Drawing, Orthographic Drawing, Dimensioning, and Careers. The drawing techniques taught are similar to those used in industry for representing the size and shape of an object to be manufactured. (This course may be used by any student to fulfill the one unit Art/Music requirement). One unit.

Electricity in the Home

This introductory level course will cover basic electrical theory and its relation to housewiring. Students will wire typical household circuits in accordance with the National Electrical Code. One-half unit, second semester.

Energy Systems

This course explores the many sources of energy and its uses. Topics include: solar, geothermal, nuclear, and chemical energy. Activities include building and testing a solar collector, model construction of nuclear, solar and hydro-electric energy systems and a home energy audit. One-half unit, second semester.

Group III

Two of the following courses should be used to complete a 3 unit sequence. Six of the following courses should be used to complete a 5 unit sequence. Recommended for eleventh and twelfth grade students.

Audio Electronics

This advanced course will cover the areas of amplifier theory, amplifier applications, sound generation and control systems. Related theory and circuitry will be taught through the use of lab experiments and a kit building project. One-half unit, first semester.

Residential Construction

This is an advanced course dealing with the many aspects of residential construction. All phases of construction from site selection and financing through interior finish will be presented. Laboratory work will include building a model home and full scale construction of a storage building which the class will assemble on site. One-half unit, second semester.

Computer Applications

This course will be presented in an application approach to teaching the basics of word processing, data base management and spread sheets as they relate to industrial applications. Other topics will include desktop publishing, graphics, computer aided design and computer numeric control. Students will trace the developments of the computer and analyze the impacts it has had on society. Projects will be completed using both Macintosh and Apple IIe computers. One-half unit, first semester.

Land Transportation

This is a general course in the study of land vehicles with a main emphasis on automobiles. Topics include fuel systems, ignition systems, lubrication systems, brakes, transmissions, consumer awareness, and auto insurance obligations. One-half unit second semester.

* Technical Drawing (Architecture)

This is an advanced level course in Architectural Drawing which will cover the topics of Culture, History, Tools and Techniques, Lettering, Aesthetics, Site Plans, Area/Room Planning, Floor Plans, Dimensioning, Sections, Framing, Exterior Elevations, Perspectives, and Careers. Students will complete a typical house plan. One-half unit second semester.

* Graphic Communications

This course is designed to introduce students to the history of graphic communications and how to plan, produce and print an offset printing project. The student will plan, design and complete a minimum of two projects. In the production of their projects students will learn the following: graphic design, desktop publishing, electronic publishing techniques, darkroom procedures, platemaking, offset press operation basics, and project finishing. One-half unit, first semester.

Principles of Engineering

This course will provide students with the opportunity to learn about the major engineering concepts and fields. The course will involve product research, design, construction and presentation. Student's will study structural forces, structural design, materials, ergonomics, packaging and specifications. Areas of study may include auto safety, machine automation and control, fuel cells and structures. Students should have two units of math, two units of science and Design and Drawing for Production. One unit, full year.

Technical Photography

This one semester course is designed to introduce the student to the basics of photography through the study of: cameras, film processing, print making, and color slide production. All necessary equipment is provided for the student, but the student does need to provide the film and paper that will be used to complete the assigned projects. This course is only open to seniors. One-half unit both semesters.

NOTE: Only one Material Processing course may be used toward a three-unit sequence.

Materials Processing - Plastics

This course will explore the areas of Raw Material Resources, Shearing, Chip Removal, Fastening, Bonding, Casting, Compressing, and Impacts of Materials Processing. The primary material used will be plastics however students will also be exposed to wood, metals, and ceramics. Eight to ten different projects will be constructed by the students. One-half unit, first semester.

Materials Processing - Woods

This course will explore the techniques used in the processing of resources. Processes include chip removal, shearing, combining, and forming. The primary material will be wood however students will also become familiar with metals, plastics, and ceramics. Laboratory work consists of several projects including the building of a mantel clock. One-half un it, first semester.

Materials Processing - Metals

This course will explore the areas of Raw Material Resources, Shearing, Chip Removal, Fastening, Bonding, Casting, Compressing, and Impacts of Material Processing. The primary material used will be metal, however, students will also be exposed to wood, plastics, and ceramics. Eight to ten different projects will be constructed by the students. One-half unit, first semester

FACILITIES

A number of strategies for modification of the physical facilities evolved during the course of this grant project. The most profound effect on the appearance of the facilities, however, was accomplished at the least expense. All ten of the North Colonie laboratories were renovated to varying degrees. The renovation evolved as a three stage project.

Stage 1: Setting the Tone

Perhaps the most difficult task for technology educators is to part with equipment no longer needed. The North Colonie faculty agonized over each item and finally developed a list of surplus equipment that was put out to bid or scrapped. Color schemes were developed for both the junior high and the high school. At the high school, the facilities were made clean and bright with a white, tan and maroon-accent scheme. At the junior high, a similar approach employed dark and light green and white. An effort was made to create specialized areas within each room, providing a clear organizational scheme. The various areas focus on testing, modeling, CAD, etc. Technology teacher, Jeff Sidor, developed a sign format that was attractive and economical. It was used throughout and provides a unifying style throughout the labs.

Stage II: Clean Room/Computer Room

The technology education program at Shaker has become more dependent on computers and computer-controlled equipment. Both the junior and senior high schools needed a clean area for a host of computer activities. At the high school, a storeroom was chosen for the computers, while a finishing room at the junior high school was appropriately upgraded. Windows were installed for easy supervision from either adjoining room. A suspended ceiling was added to lower the junior high's twelve foot ceilings. Supplemental electrical outlets were provided. Painting the facilities in a color scheme to match that used in the labs added a finishing touch to the junior high setting. At Shaker High School, a carpet remnant, folding leg tables (approximately $30 each), and computer chairs (approximately $40 each) were acquired to help create a professional atmosphere. The programs' robotics, CNC & CAD equipment, along with the computers, printers and plotters are housed in these rooms.

Stage III: Acquiring Equipment

Acquiring equipment was, without question, the most costly phase of the renovation effort in North Colonie, where a five year equipment replacement plan was underway. The NETEC grant accelerated this process. A large number of manufacturers donated, loaned, or discounted their equipment and supplies in support of the NETEC initiative.

The NETEC effort has provided a needed spark to the critical process of renovation and upgrading. The funding and donations received through the grant, along with considerable elbow grease and imagination, have significantly improved the appearance of the facilities and created a setting that is stimulating and attractive. Students have been excited to see the transformation and use the "new" facilities. These changes, along with the curriculum changes made in previous years, have resulted in a new image for technology education.

Ponaganset Middle / Senior High School

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42

OVERVIEW

School & Community

Ponaganset Middle and High Schools serve the towns of Foster and Glocester located in the northwest corner of the state of Rhode Island. Both towns are considered bedroom communities and are somewhat rural in nature. There has been much population growth in both towns in the last 10 - 20 years, with particular influx of educated, professional people, causing a transition both economically and philosophically. The communities are largely Caucasian in make up with about 1% representation from minority groups. A high percentage of residents are high school graduates and about 20% have college education, although this number is increasing rapidly.

Farming, lumbering and retailing occupations employ a percentage of the residents of Foster and Glocester. The remainder are employed in nearby cities. While the number of professional persons has increased over the past four years they are not the majority. Cultural and social activities center around the local churches, libraries, granges, and more increasingly than ever, the school itself.

Students are transported to school by bus at the public expense. Approximately 62% of the last graduating class went to four year colleges and another 34% plan to attend other post-secondary schools. This represents an increase over the last decade. Test scores are at or above the state of Rhode Island average. A number of students transfer to private and other schools after middle school, and an approximate 8% dropout rate is experienced by graduation time.

The townspeople are interested in supplying a quality education to all of its students. The High and Middle schools are getting more and more support from the two towns. It seems that high academic expectations, standards and rigor are expected of the schools. In general the budgets submitted to the townspeople by the school committee have been supported and adopted in the last five years. In addition, a twelve million dollar addition program has recently been completed to both the middle and high school buildings. The school committee also invested $500,000.00 in up to date technology, making the region a trendsetter in the state. The music and technology education are award winning programs that have been nationally recognized.

THE CHANGE PROCESS

Change is a very difficult thing. Everyone progresses through this process at different rates and with varying degrees of success. Even successful change has mixed outcomes. At Ponaganset it was no different. We had our good and bad days. We first heard about the NETEC Project in the Spring of 1990. Dr. John Wright, Dean of the School of Technology at Central Connecticut State University organized a meeting in Auburn, Massachusetts among six universities, and seven State Supervisors for Technology Education. He spoke of a federal grant to establish national demonstration sites for technology education. He said he wanted to form a consortium and invited everyone present to participate.

When our faculty heard we had been selected as one of the demonstration sites, the initial reaction was mixed. There were a lot of discussions about the implications of being a demonstration site. Some members of the faculty were very enthusiastic and willing to charge right ahead. Others were more reserved, and some were even against it. These discussions carried on pretty heavy for several months, with comments both positive and negative. Some examples are: "I don't think you people realize just how much work this is going to be . . . I really don't think you understand." "We've tried that already." "If it doesn't spit chips, or have blue sparks then I want nothing to do with it." Sound familiar? Our school really is no different than other schools—which was the whole premise behind NETEC.

Before the NETEC project began, we had already started moving toward technology education. The faculty was already incorporating Technology Learning Activities (TLA's) into the curriculum. However, on paper, we were still very traditional. Our high school program offered Woodworking I-IV, Electricity I-IV, Drafting I-IV, and Automotives.

One of the biggest problems with starting a new program is the compelling need we often feel to throw out everything we've been doing. "Okay here comes the new Saviour of education, let's toss everything aside and start from scratch." This is a process we seem to repeat about every five years. At Ponaganset, we took a long hard look at our existing curriculum, decided what was important THEN dumped the rest.

After we figured out what was important, we reviewed many new textbooks and decided what changes should be made to our EXISTING curricula to make them more relevant. Once we established our curricula, we started cleaning out our labs and getting rid of old or outdated equipment. If you look around, you'll be surprised just how much stuff you've "acquired" over the years. Don't just throw things out! A lot of heavy equipment can be traded or sold for scrap. We purchased several CNC machines with the equipment we discarded.

Retraining is an important ingredient in the change process. The entire faculty went for two weeks of training in the summer, and for two weekends during the year. In addition to formal training virtually everyone spent hours with reference manuals trying to become proficient with new equipment and software.

The Advisory board attended bi-monthly planning meetings at CCSU and the various NETEC sites. They brought back new information, ideas, and methodology which was shared with the entire faculty. I can't stress the importance of having frequent, short, informal meetings to keep everyone on task, and up to date with what is going on. These meetings had the greatest imon our department's paradigm shift. It allowed us to explore the pros and cons of what we were doing, and really helped bring everyone on board. It's really unbelievable how much some of our faculty have changed. Now that they've had some real experience with technology education, I defy you to take away their new programs and equipment.

After you make all these changes, you need to market your program. It is important to educate administration, guidance, and the student body about what you are doing. We had our students design a logo which we've placed on departmental stationary, t-shirts, and three-foot tall signs hanging outside our rooms.

Here are a couple of recruiting hints you might find useful. Just before student scheduling we ask homeroom teachers (you can also use the English teachers) to pass out flyers which contain all our classes. We also hang 4'x 8' banners in the cafeteria. If you design classes with a Pre-engineering flare you have a very good chance of recruiting college bound students. To sell our program we visit the advanced/honors math and English classes with a laptop computer and a couple robots and do a dog and pony show. This technique has been extremely successful.

Everything hasn't been roses. We've spent a considerable amount of time upgrading our facilities, curriculum, and learning new equipment. We've had almost 400 visitors in the last two years. It can become a real distraction when you have visitors in your class three or four times a week. Even with all the work, distractions, and aggravations, it is one of the most rewarding things I've ever done. If you polled our faculty each and every one would do it again.

CURRICULUM

Middle School

Ponaganset Middle school students are all required to take technology education in each of the three grade levels, 6th, 7th, and 8th grades. Technology education is one of the Special Areas (in addition to art, health, and home economics) that the students rotate through at each grade level. Students rotate each quarter of the year giving them approximately 24 contact hours in each special area. Classes meet every other day for one period throughout the quarter.

Technology Education covers the areas of communications, manufacturing/construction, transportation, power/energy. The curriculum is a series of Technology Learning Activities (TLA) that students work through to fulfill their requirements for each grade level. All TLA's have a math, science, technology interface and teaming is done with these areas whenever scheduling permits. The specific curriculum for each grade as it is currently written is outlined below:

6th Grade Transportation Production

- Design, build, and test a rubber band vehicle

Technology Learning Activities

- Brick Tower (construction)
- Lunar Lander (egg drop)

7th Grade Communication Systems

- Board Drafting
- AutoSketch
- Microwave Communication
- Laser Communication
- Satellite Communication

8th Grade Construction/Transportation

- Legos - Tractor Pull
- Legos - Vehicle for Speed
- Pneumatics
- Models of Geodesic Domes

High School

The following is a copy of a curriculum flier distributed to the students at Ponaganset High School in a attempt to inform them of the changes to the technology education curriculum:

PONAGANSET TECHNOLOGY EDUCATION

A NATIONAL DEMONSTRATION SITE

(one of five schools selected in the country)

Be a part of our award winning program!

976 COMMUNICATION AND ENGINEERING TECHNOLOGY

This course deals with problem solving and the use of lego as the system platform. This class will explore satellite. television, radio, and other electronic communication systems.
1 credit

960 GRAPHIC COMMUNICATION AND COMPUTER ASSISTED MANUFACTURING (CAM)

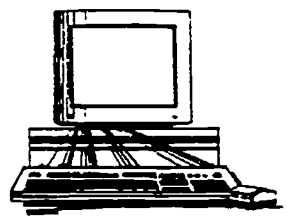
Documents are composed on a computer using PAGEMAKER , then produced on an offset press. CAM involves the creation of 3D models on a computer which are automatically produced by numerically controlled machines.
1 credit

930 POWER AND ENERGY TECHNOLOGY

This course deals with the sources. generation, uses. and environmental impacts of six energy sources. Field trips and experimentation provide insights into solar energy, fusion. and other alternate energies.
1 credit

959 AEROSPACE ENGINEERING

Students will design and build a self sustaining moon base. The effects of reduced gravity, establishing water and food supplies, construction materials and techniques, alternate energy sources and propulsion systems are explored. A 3 Dimensional computer model will be generated from the classes design. This course involves a partnership with BROWN UNIVERSITY
1/2 credit



919 COMPUTERS AND TECHNICAL DRAWING

This course provides the basic fundamentals of computer aided drafting, and animation. Visualization and the ability to think in 3D are emphasized. Problem solving, product design and basic drafting skills are also developed.
1 credit

958 ROBOTICS

Using the Fischer Techniques Robotics Modeling system students will design and build a variety of Robots. They are capable of sensing light, heat, movement, and color. The Robots must be attached to a computer using an interface and programmed in basic. Students are encouraged to produce original designs.
1/2 credit

918 WOODWORKING TECHNOLGY

Deals with the fundamentals of fabrication and construction. A variety of machines and methodology are utilized to produce the desired design.
1 credit

916 ELECTRICAL TECHNOLOGY

This course provides the electrical theory necessary for further study. Topics include: residential wiring, meter reading, and circuit construction.
1 credit

You are invited

TO THE 21ST CENTURY!!!

Ponaganset Technology Education flier (page 2)

937 ARCHITECTURAL DESIGN

Learn how to design your dream house, select a community, and a house lot. Current building practices and design factors will be studied. A set of blueprints will be produced. Passive solar design and site development are emphasized.

EEP CREDIT IS AVAILABLE
1 credit

927 DRAFTING TECHNOLOGY 2

The concepts learned in Computers and Technical Drawing are expanded on. Periodic design problems and group work are utilized to emulate an engineering setting.
1 credit

957 COMPUTER AIDED DESIGN AND DRAFTING

Advanced 3 dimensional solid models are constructed. These models can be evaluated to determine mass, volume, products of inertia etc. Computer animations of these models are created. For ex. Walking from room to room inside a computer generated house.
EEP credit is available
SATISFIES COMPUTER LITERACY.
1 credit

928 MANUFACTURING TECHNOLOGY

Using the skills taught in woodworking technology the students will work in groups and individually to study the manufacturing system. Students will build prototypes do marketing and feasability studies, and manufacture products. 1 credit

938 ADVANCED MANUFACTURING TECHNOLOGY

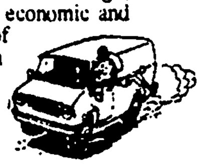
Students will develop several manufactured products using numerically controlled machines. Quality control, and precision measurment are emphasisezed. The benefits of conventional practices and Computer Assisted Manufacturing will be contrasted.
1 credit

948 ADVANCED MANUFACTURING TECHNOLOGY 2

A continuation of the 1st year where students will go further into computer assited manufacturing and machining.
1 credit

951 TRANSPORTATION TECHNOLOGY

Role playing, hands on experience, and experimentation are used to explore the four environments of modern transportation. The design, construction, economic and social costs of transportation are evaluated with state of the art equipment including magnetic levitation systems and alternate fuel vehicles.



1 credit

956 ELECTRONICS TECHNOLOGY

For the beginning student in electronics. Electronic components are used to construct basic circuits, test them, and then used to construct projects that reinforce those concepts. Strobe lights, color organs, and amplifiers are examples of required projects.
1 credit

966 ELECTRONICS TECHNOLOGY 2

Students will build on the theory explored in 956 Electronics Technology, and spend more time on independent projects which use this theory to repair sstereos, VCR's etc.
1 credit

LET'S TALK TURKEY!

Our department is one of five National Demonstration Sites for Technology Education. As part of the Northeast Technology Education Consortium we have formed a partnership with six universities and over thirty private companies. This resulted in over $250,000 being donated to our department.

These donations enable us to provide training on robots, lasers, satellites, fiber optics, and in computer drafting, animation, and manufacturing. We are currently utilizing the same equipment as local colleges, universities and industry.

Technology Education provides an opportunity to apply the concepts and theories learned in math, and science, in a problem solving setting.

In addition Communications and Engineering, Robotics, and Aerospace Engineering have been specifically designed for the college bound student.

For more information contact your guidance counselor and/or a member of the Technology Education Department

Electives provide an opportunity for students to select courses that intersest them, or meet their individual career needs. Exercise your rights!!!!!!

FACILITY RENOVATION

The Need for Renovation

Technology education is generating a lot of excitement around the country. Our ability to prepare students for the transition from school to work and college has captured the interest of many educational reformists. School systems have begun to incorporate the goals and methodology of technology education. A lot of very exciting activities are being implemented around the country. Unfortunately, the majority of time and effort is devoted to curriculum, while facilities are almost totally ignored.

Many people, including, parents, teachers, and administrators base their judgments of technology education on their own memories of high school shop class. As a profession we work very hard to discard these stereotypes and preconceived notions. We spend our time trying to generate support, and convince the general public technology education is educationally sound and essential for all students. And just when we finally convince people to come down and view these wonderful activities, upon entering the room they immediately think, "Oh this is just a shop class."

It is extremely important to provide a visual image of change. A properly renovated facility will allow your guests to focus on the excitement and interest your activities are generating. By the time they realize they are in a lab the concept of technology education will have already sunk in.

As a result of a local building program Ponaganset's Technology Education Department was provided with two new labs at the high school, and one at the middle school. These rooms are white, bright, and filled with computers. "Shop" is the last thing that comes to mind.

In addition to these rooms our department renovated four existing labs. All the labs both existing and new have been equipped with a 27" high resolution television monitor. The cost of redoing a lab can range from $200, or $300 dollars to several thousand. At the lower end of the spectrum, it is absolutely amazing what a fresh coat of paint can do.

Strategies

Facility renovation and curriculum revision should go hand in hand. When selecting new activities one should consider the space and equipment required. "Is my room really set up for problem solving, or think tank activities? Is the physical arrangement flexible enough for the various activities I am planning? What changes if any would I like to make?" One must consider the type and placement of furniture, electrical supplies, lighting, color schemes, etc. The ultimate goal should be to design not only a laboratory, but a learning environment.

The word shop conjures images of 4' x 4' maple benches with a vice on each corner. Not only do these benches reinforce the stereotype of industrial arts, but they are often inadequate for the needs of technology education. Ponaganset rectified this problem with the addition of the "John Plas memorial" benches. These octagon shaped benches are eight feet across the flats, with electrical outlets in the middle, and supported by four cabinets. They are made by joining two 1-1/2" thick laminated 4' x 8' sheets of plywood in the middle, and cutting off the corners.

These benches are large enough to easily accommodate eight students, and also provide storage. They provide flexibility that will permit several small group activities, or a large collaborative effort. These benches were manufactured by our students, and can be made for under $500.

Remember an important key to technology education is flexibility. We use informal office partitions to separate unrelated activities. This enable us to separate activities without permanently partitioning a room.

You will find it is often unnecessary to purchase this type of furniture. Local companies often have surplus, or old office furniture which they are willing to donate to schools. Our local newspaper donated all the office partitions and a number of two drawer filing cabinets, which we used as bases for the octagon tables. Using existing or donated bases reduced the cost of these tables to under $100.

The largest investment in any renovation will be time. The faculty and students at Ponaganset invested a substantial amount of time in the planning and remodeling of these labs. Student involvement created a sense of ownership in the program which carried over to our curriculum revisions. They really have become active participants in the educational process. Students frequently come out of study halls, and after school to complete activities. They are reading reference magazines and often inform us of the latest trends and innovations.

If you anticipate a problem with the local union over using student workers, talk to them. Explain what you are trying to do, and why. They might be more receptive than you think. Some might paint the room for you, while others will provide the paint and their support. If problems arise, most schools have some type of carpentry or construction class, which could easily justify these student activities.

New Facilities

Prior to our selection as a NETEC site, we were in the process of adding on to both the middle school and high school. These additions provided us with two new labs at the high school. These rooms are located in the same corner of the building as the Mathematics and Science Departments. They have twenty four computers between them, and are outfitted with brand new furniture. These rooms share an adjoining office and have a display case located in the corridor. Both rooms are equipped with bookshelves and magazine racks which hold reference books and relevant periodicals.

We use the display to store the students' robotics projects. This results in a display case which changes every day, and chronicles the work in process. This case has been an invaluable advertising aid. If you are planning to add or revise a case, make sure it has an outlet, and shelves wide enough to hold a computer. When students are selecting courses, we place a computer in the case with some working robots.

The curriculum has a pre-engineering emphasis with a strong concentration on problem solving and the design process. Each course is assigned a particular room. However, you would not know it based on the activities that take place. There is a free flow of ideas and activities. Problems started in one room are often reinforced, or finished in the other.

Graphic Arts/Computer-Aided Manufacturing

Graphic Arts and Computer Aided Manufacturing are currently housed in the old drafting room. An office partition was used to separate the two areas. Our students repainted this room and replaced the existing 2' x 4' drop ceiling with 2' x 2' panels. The white walls, counters, and a new ceiling were all designed to give this room a high tech look.

The CAM equipment is the result of donations from four vendors. If at all possible avoid large stationary machinery. Small table top computer controlled lathes and mills will have the same end result, while providing the necessary flexibility for a technology education laboratory.

Communications/Engineering

This lab is primarily used for instruction in electronics, lasers, robotics, communications technology, and satellite communication. There are two central islands with four work areas around the perimeter. The electrical power for this room is provided by outlets located in the floor. This allows the room to be rearranged as necessary.

Each workbench contains a strip of outlets. There are eight computers in this room. The computer bases, monitors, and keyboards all sit at eye level on a shelve about 18" above the bench. This leaves the bench tops free for activities requiring construction and fabrication.

In the Communications and Engineering (C/E) course, students must videotape all completed projects. They periodically present their ideas and models to the class. These presentations are then viewed on the classroom TV monitor and critiqued by the class.

Computer-Aided Drafting/Robotics

Our CAD lab is also used for computer animation, robotics, and aerospace engineering. There are sixteen drafting tables with three counter tops running adjacent to the rows of desks. A computer sits on the counter top at each desk. A student accesses a computer by only rotating 45 degrees. We believe that it is essential to teach CAD and drafting interactively.

The electrical power is located on the floor underneath the counter tops. It can be very difficult to compete with a computer for a student's attention. To rectify this the duplex outlets were split wired and are controlled by two switches in the front of the room. One switch controls the computer monitors, and the other one controls the bases. This enables the instructor to switch off the monitors in the middle of class, without destroying the students work. We strongly recommend this arrangement for any computer facility.

The Aerospace Engineering program requires students to develop a self sustaining lunar colony. Students use the computers to generate graphs, AutoCAD drawings, computer slide shows, simulations, and animation with 3D Studio and Animator Pro. Like the C/E course student presentations and work are videotaped and critiqued. We have a VGA to NTSC converter which we use to display all our computer graphics on the classroom TV monitor.

Manufacturing/Transportation

Visually these two labs appear the most traditional. One has a car lift and the other still contains some of its original woodworking equipment. However, by comparison these rooms are visually striking. As previously stated, it is amazing what a couple gallons of paint will do for the atmosphere of a room. Our students painted the walls with pastel colors, the trim in mauve, and replaced all the ceiling tiles. They sanded and refinished all the bench tops, and made two octagon tables for the transportation laboratory.

None of the machinery is hard wired. It all can be easily disconnected and pushed to one side for large activities. Last year the students designed and built a geodesic shelter with a base twenty feet in diameter. One can buy OSHA approved rolling bases for any large equipment. Remember flexibility is one of the keys to a successful technology education program.

In addition to the facility changes a serious curriculum revision was undertaken. The manufacturing process is now evident. Students concentrate on mass production, marketing, and quality control. The transportation students have built solar cars, raced magnetic levitation vehicles, and explored alternate energy sources. The octagon tables are used extensively for problem solving, research and development, and brainstorming.

Middle School

With the upgrade of the middle school labs strong emphasis was placed upon the four clusters of communications, transportation, manufacturing, and construction. As with all laboratories, the rooms are bright and airy with large work areas, and very little of the old "heavy" machinery associated with industrial arts.

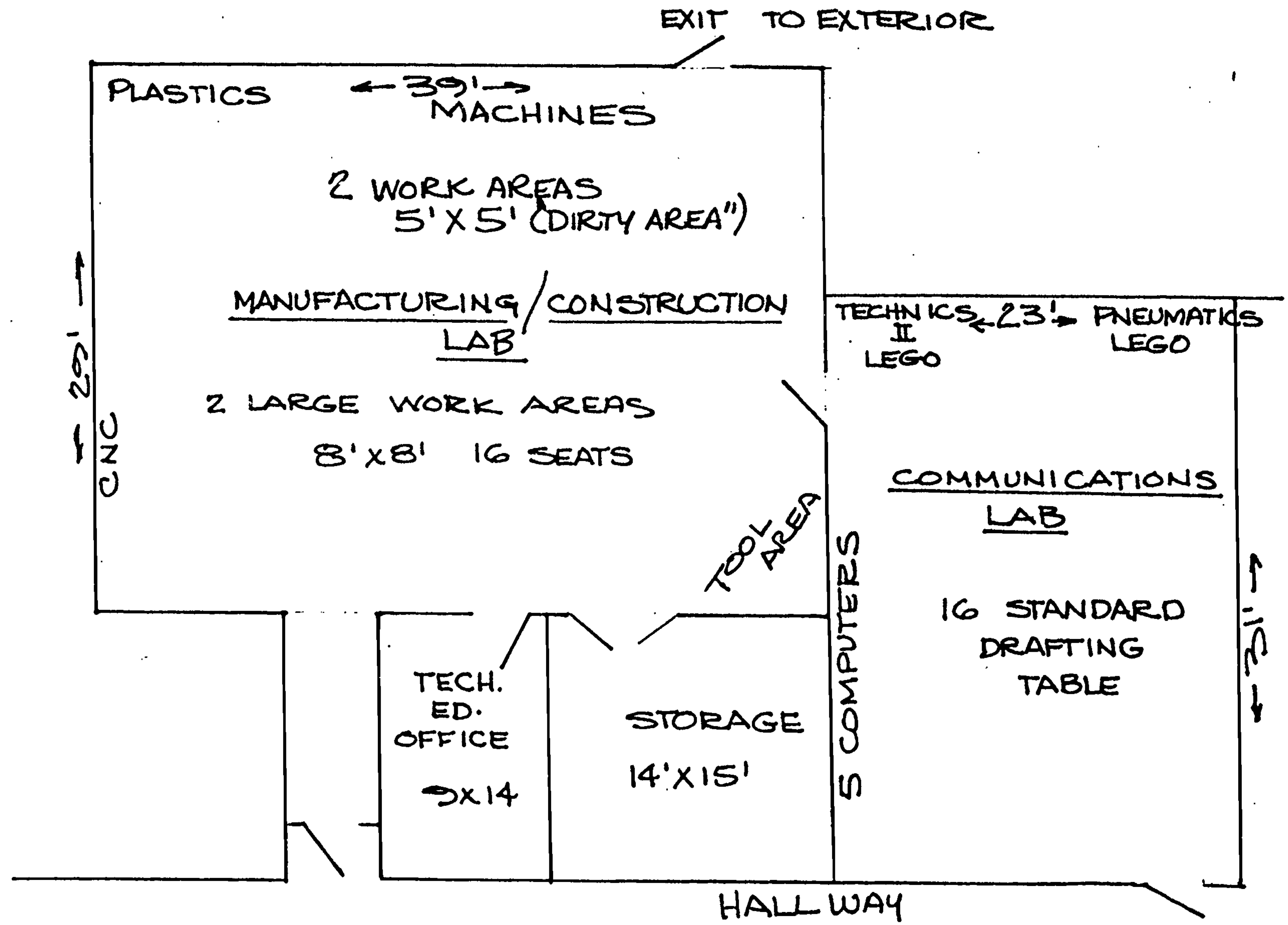
The middle school consists of two adjoining labs. The communications laboratory contains drafting tables which the students use for all design work. The manufacturing laboratories contain two octagon tables which are separated from the actual machines by a four foot office partition. The middle school is placing a strong emphasis on exploration at all grade levels, so the transition from middle school to high school technology education will have relevance and continuity.

Summary

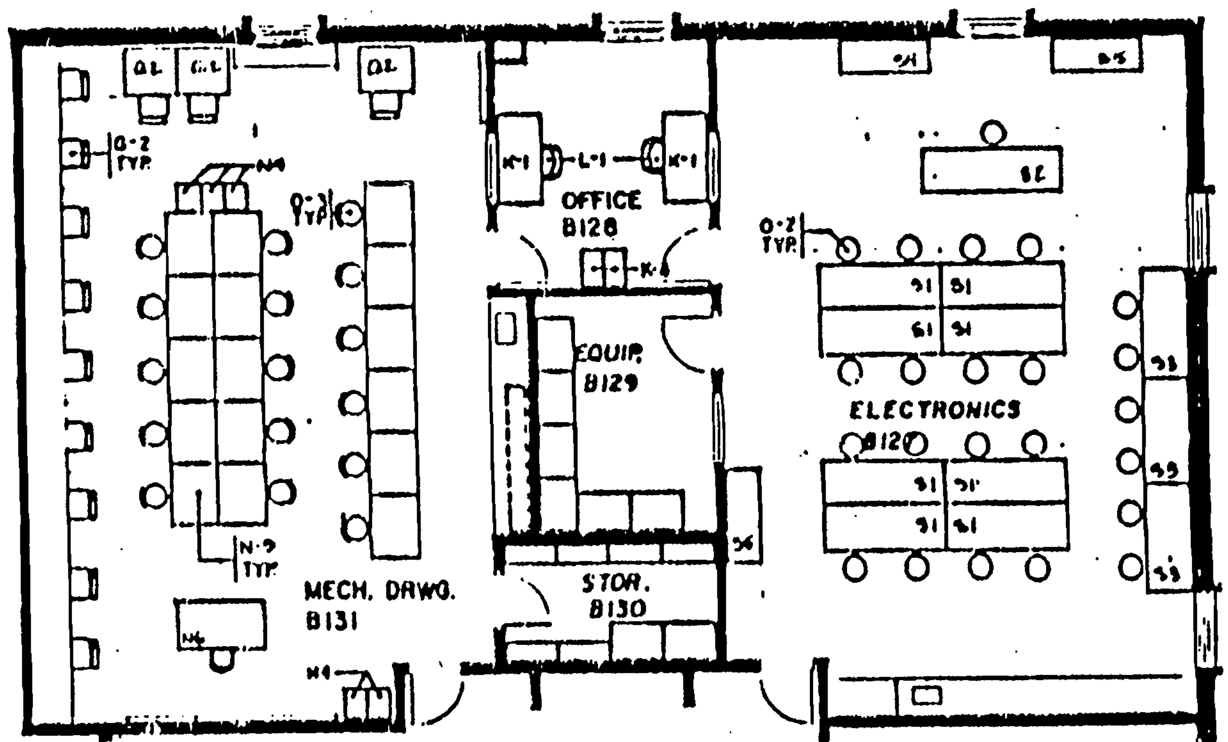
In our increasingly high tech society we are doing our students an injustice by concentrating on books. There are a variety of other resources: computer information and retrieval systems, modems, CD-ROMs, cable-TV, magazine articles. Great pains have been taken to encompass a large variety of technology into the various programs offered by this department.

Computers and other technologies are not an end in and of themselves. However, we believe they are essential components of any educational system designed for lifelong learning. They should play a major role in any facility revision. Let your curriculum needs drive the facility renovation. Having the appropriate space and equipment enhances the outcome of any activity. A renovated facility makes a very good first impression. Without one, no matter how good your activities, you might always be just a shop teacher.

The next two pages contain floor plans for the middle school and the new high school laboratories.



Middle School Technology Education Laboratories



Partial Floor Plans for the H. S. Mechanical Drawing and Electronics Laboratories (New Addition)

55

56

Riverside Middle School

John Plas, M.S. Technology Teacher

183 Summer Street
Springfield, VT 05156

OVERVIEW

Springfield is located in southeastern Vermont on the Connecticut River. It is a blue collar community known as the "machine tool valley," with a rich history in the machine tool business. A community of approximately 9,500, it is struggling to diversify its local economy and provide good jobs.

Riverside is a rural school with a population of 380 students in grades 6 - 8. They are a lower middle class community with virtually no minority population with a 15% drop out rate and about 55% pursuing further education. Springfield has one high school, one middle school, and four elementary schools.

Springfield is a progressive school system participating in a variety of innovative programs. Riverside is adopting a TEAM concept for 1993-94 which will allow teachers to work in teams to enhance the student's learning experience and we are participating in the New American Schools Program to restructure schools. The technology education classes consist of a required 9 week course in sixth grade, a required 9 week course in seventh grade and two optional 18 week courses in 8th grade.

THE CHANGE PROCESS

While the transition to technology education is a long evolutionary process, I believe there are four identifiable stages of transition:

I. Realization - Most of us are very comfortable with our subject matter and cannot see the immediate need for change. We have had wonderful experiences with woods, metals, and drafting, and would like these subjects to continue. Realization takes place when the teacher accepts the inevitable and begins the process of changing his or her curriculum. Joining professional organizations, taking workshops and courses will help begin the transition and gather information for experimenting.

II. Experimentation - After realizing the need for change, it will be important for the teacher to begin to experiment and find a new comfort level. He/she should become comfortable with change and understand it. There are a lot of new and exciting tools and process and it can be an enjoyable experience. The teacher begins to look at curriculum through the students eyes and starts to design curriculum around the needs of the student and not his/her personal comfort zone.

III. Visualization - After experimenting with activities and gathering information, the teacher can now visualize the direction of the program. They begin to make long range plans, a time line is developed, curriculum is fully developed, the facility begins to change, and the teacher begins to think like a technology teacher. He/she is gathering resources and, it is often the case that he/she may actually begin promoting technology education.

IV. Implementation - Industrial arts no longer exists. Custodians, secretaries, teachers, students, and parents have accepted and acknowledge the transition.

I am convinced, like snow flakes falling from the sky, there are no two identical school systems in United States. There are just too many variables influencing our schools. All industrial arts teachers will go through these four stages at their own pace and in their own sequence. However I believe the transition will be smoother and quicker if these four steps are followed in recommended order.

Staff Development

There are no secrets. There are no short cuts. In-service programs, workshops, graduate courses, institutes are needed to make the transition. However, professional organizations play the largest single resource for teachers making the transition. They will provide information about institutes, conferences, model programs, and guidance. They exist for your benefit and are worth the investment on your part. Get involved in the ITEA and your local and or state technology education associations. You are not alone in this transition. Other teachers are very willing to share information and new ideas.

CURRICULUM

Sixth Grade Foundations of Technology Education I

The sixth grade experience will introduce technology in a changing world. We will discuss the differences between science and technology and introduce the students to technological resources. We will study how technology affects our lives and how to control technology through technological literacy. We will discuss the systems approach to technology and concentrate on the transportation and communications systems. Foundations of Technology will promote computer literacy and introduce students to computer applications used in industry. Activities might include; electronic experiments, construction of simple machines, computer aided manufacturing and design (CAM/CAD).

Seventh Grade Foundations of Technology Education II

After a short review of the sixth grade program, the seventh grade will concentrate on problem solving methods as applied to technological systems. We explore manufacturing and construction systems. Emphasis is placed on research and design, mass production and industrial management. Activities may include mass production project and building a CO_2 cars.

Living With Technology I

Production Technology (18 weeks) — Approximately nine weeks is spent studying construction systems. The major project includes designing and building a model of a multiple housing project. The second nine weeks is spent building and selling mass produced clocks or any other project using the manufacturing enterprise method. A company is formed, and a product produced and marketed for a profit.

Living With Technology II

Communication and Transportation Technologies (18 weeks) — Nine weeks is spent working with communication technologies. Computer applications in industry (CAD/CAM, Robotics) and audio & video applications (radio & T.V.) The second nine weeks is spent on transportation (land, rail, air, electronic, etc.) and power and energy (electronic, atomic, water, combustion, and so forth).

FACILITIES

The facility is an older building with one instructor and a large general technology laboratory (formerly a woodworking shop). It is a carpeted facility with a special modeling area and a construction site box. The facility features technological islands, a CAD/CAM horseshoe, electronics communications area, resource center, and a flexible classroom/planning area. It is a 3,000 sq. ft. facility capable of handling up to 24 students. A variety of activities are utilized following the Vermont State plan for Technology Education.

Recommendations

Recommendations from Nathaniel Hawthorne I.S.

Once you make the commitment to change, convert, or upgrade your program, the rest is easy. We've listed what we feel are some of the best tips and techniques to help. As always, feel free to visit or call for assistance.

Visit other schools. See what other programs have done.

Talk to other technology teachers. Share ideas and information. If you have a good activity, share it with your colleagues.

Start Slowly. "Rome wasn't built in a day." One activity at a time. Try it and then improve on it after you've tried it.

Work on things that interest you. You'll have more success teaching your students if you enjoy what you're teaching and have an interest in it. But remember your passion may not be shared by your students. Many teachers hang onto woodworking because of their love of the material.

Don't be afraid to add new activities. Try new activities and ideas. Your curriculum should be constantly evolving and improving. Eliminate or change activities that you feel don't work well or you're uncomfortable teaching.

Use your imagination. Be an inventor, an innovator, and an adopter in your own lab.

Appearance counts. Just a few changes: a fresh coat of paint, a few painted icons, a stripe, a special corner of the room, or anything else that you might try will make things better.

Talk to teachers who teach in other subject areas. Get acquainted with their curriculum, whether it is mathematics, social studies, science, art, English, music, and so forth. Cooperate with them. See how technology is related to their curriculum and emphasize the relationship in your class.

Incorporate other curricula. Remember that technology education is the practical application of other subject areas. Tie into them. Relate other curriculums to your activities. Show how they apply to real life situations.

Stress problem solving. It is no longer " what is the next step in the procedure? " Now it is "how do I solve the problem?"

Encourage creativity. Try to provoke original ideas. Reward students who are willing to experiment, even if their solutions turn out to be unsuccessful. Explore and help to show students the reasons why solutions don't work . . . this is true learning.

Encourage competition. Challenge the students' toward achieving goals.

Recommendations from Riverside Middle School

Maintain what you presently have, don't let your existing facility depreciate. We all have different situations with individual problems and strengths. However, we can all make improvements in our existing facilities with a little effort and ingenuity. A clean, organized, well maintained classroom has a better chance of procuring support from administrators and parents than and dirty, unorganized shop. It is difficult to have faith in an individuals ability to change successfully when they can not maintain what they presently have.

Use your space efficiently and do not keep things you are not using. The size and the number of rooms in your school will depend on the age of your building, the number of teachers in your department and the role your program has played in the past. Many of the industrial arts programs of the past are downsizing for a variety of reasons. This has left many of us with unused rooms and too much storage space. Your students need that space. They are full of energy and need room, particularly middle school students. Also, the size of our discipline and current trends in education require more space. Technology Education is inclusive not exclusive, the breadth of what we teach grows as technology grows exponentially. If we are not using that space now, we will loose it. We will surely need it in the near future and should be using it now.

Recycling is in! Extra space has historically been unintentionally turned into junk yards. Industrial arts teachers were recycling long before it became a trend, the old scrape boxes were around years before recycling bins and most of use recycle every day. Most of the old projects, machines, tools, and materials we have collected can be used by someone. If you're not using it, sell it or trade it for something you need. Raffle it off, give it away or throw it away. If you don't have plans for a machines, tools and materials and you've stored them for more than two years, you should move it out of the tech lab and use the space for student activities. Administrators, parents, fellow teachers and students will be impressed by activities not storage.

Avoid designing a facility around a project(s) or activity(ies). Design flexibility into your facility. In order for us to design a technology program we must think like technology teachers. Place yourselves in the students shoes, and visualize the role of technology education as general education. We are fast becoming integration specialists and are capable of producing a newsletter, designing a space station, or mass producing furniture. Design clean, comfortable, open spaces with large table tops and electricity at every station. Put as many things on wheels as you can and avoid permanent fixtures. This flexibility will allow you to adapt to changes quickly and avoid costly redesigns in the future.

Industrials arts programs have historically been project oriented. We tend to design facilities around a favorite project. I do not have a crystal ball, but I can guarantee our discipline will continue to change. We are already beginning to label some technology education activities as traditional. You may not have another chance to re-design your facility, so you had better make the most of it. The activities we are using today may not be the activities we use tomorrow.

Do not limit yourself to local or existing resources. What resources? Information, people, machines and tools, materials, capital, time, energy. Technology teachers are among the most resourceful teachers in education. We can make changes in our classrooms other teaches can't (e.g., build walls and cabinets, paint rooms). While designing your facility ask other teachers students and parents for help. Use the funds you have available for remodeling and make it part of your classroom activities. We are problem solvers, designers, writers, and visionaries. We need to call upon these strengths to make this transition.

As education changes, funding for education is changing with it. Today, teachers need to look beyond regular local budget to finance some changes. Grants, bottle drives, local industries are all valuable sources for program changes. The gate receipts from one middle school dance can finance a lot of remodeling in a technology education facility. Each community is different, but they all have alternative funding sources. Ask your principals, students and other teachers. It is extra time, but with a little success you can get the ball rolling and start your transition.

Concentrate on what you can do now and temporarily put aside what you're not able to do immediately. The enrollment has dwindled, your system is financially strapped, there is no sense dwelling on the short comings and failures of the past. Learn from them and go on. The educational climate has changed in many school systems. The same administrators and teachers who fought change in the past are now under pressure to change themselves. There are books, professional journals, government reports all demanding change in our schools. Plan your transition and take it one step at a time.

The big ticket items can be the most difficult. The computers, video equipment and some furniture can be difficult to fund. Start remodeling the sections of your room you can do today, and work for the resources to make the changes you want tomorrow. When a student gets stuck on a question on a test we tell them to skip it, go on the next question and come back to it later. When you come to a part of your plan you cannot implement, skip it and come back to it later when you have the resources.

Recommendations from Michael Barnes[1]

The following passages explore some general topics and concepts related to change. They should help you in virtually any setting.

FALSE EXPECTATIONS - This is one of the biggest problems you'll encounter. Try to be realistic when setting your goals, and objectives.

TIME - Don't let anyone kid you, change takes time. It also requires a substantial commitment from the parties involved. Since NETEC began three years ago our department has worked before and after school, on weekends, and during the summer.

COMMITMENT VARIES - Not everyone will share the same "vision" or be willing to invest the same amount of time. Some people will need to improve basic skills, or learn new equipment, whiles others undergo a paradigm shift. This may be hard to believe but not everyone will see the benefits of your "new" idea. Some might even claim "It won't work!" or "We've tried this before"

LEADERSHIP - To change you need a leader, someone with a vision. Someone willing to invest the time an energy necessary to ensure the success of the proposed changes. Contrary to popular belief there can be more than one leader. At Ponaganset, we had two who worked as a team. Each one assumed different responsibilities. No one can do it all. Having someone who shares your philosophies, someone to bounce ideas off, and to remind you there is a light at the end of the tunnel is definitely desirable.

THE ROLE OF THE LEADER - A leader must walk a very fine line between too much and too little. He/she must lead by example, encouragement, and cooperation, not by decrees and mandates. A leader must have a clear and focused vision and the ability to articulate that vision to others. A leader must have the respect and trust of the people he/she plans to lead. And most importantly when trying to implement change a leader MUST give people time to figure out what that change means to the individual. Without time to reflect on the personal implications, people won't see the relevancy of change. Consequently, they'll only give a half-hearted effort if they try at all.

Change will require time and effort, but in the end it's usually worth it. I offer the following as food for thought:

> 10 YEARS MAX - You may have an outstanding program. However, if you've been using the same lesson plans for 10 years or longer, I'd say you're probably doing it wrong. Think of how much the world has changed in the last decade. Ten years ago, the microcomputer was virtually unheard of, today it is an integral part of our society.
>
> CHANGING JOBS - Studies show the average American will change jobs seven times in the course of his life. We are doing our students a serious injustice if we continue to train them for only one job. Education can no longer be skills based. However, we can, and should, provide them with the skills they need for all jobs.

[1] Mike Barnes is one of the technology teachers at Ponaganset High School, RI

80% NEVER EARN A BACHELORS DEGREE - According to the December 1992 issue of *NEA TODAY*, 80% of all students never successfully complete a four year degree. Start with 100 students. We have a 20% drop out rate, that leaves 80. Proportion of U.S. high school who don't go to college: half. That leaves 40 students. Proportion of U.S. college freshmen who don't graduate: half. That leaves only 20 students who successfully completed a four year degree. In essence were allocating 80% of our resources for 20% of the students.

PROFESSIONALISM - Think of the time you invested in teaching at the beginning of your career. You were new, nervous, and unsure of your competency. Consequently, you put a lot of time into developing your lessons and your programs. Unfortunately, after this initial commitment some people lay back and rest on their laurels. If we are going to keep claiming teaching is a profession we must start acting like one. I think we have a professional responsibility to stay current and constantly improve our personal knowledge and skills and our programs.

Technology Learning Activities

The following is a sample of some of the technology learning activities (TLAs) used or developed during the NETEC Project.

Riverside Technology Activity Technology Education

Title: Tractor Pull

Type: Secondary

Problem Brief:

John Deere is developing a new tractor and they are looking for a more powerful transmission to use for their tractor. They are promoting a tractor pull contest as a method for finding the best transmission. All of the best engineering firms are competing and the winner could receive millions for their patent.

Goal:

Design lightest vehicle using Lego components that will pull the most weight the furthest distance per second.

Requirements & Limitations:

1. The simple machines information sheet and quiz must be completed before you begin.
2. Tech Ed competencies must be passed before you begin your tractor.
3. A problem solving sheet with sketch of completed tractor on the back must be completed.
4. You must record your score on the chart provided.
5. Each student will work with no more than one student.
6. Each student will use the formula provided below to determine their efficiency score (include math with problem solving sheet).
7. You must program the tractor to run for 24 seconds using the simple logo commands provided.

DATE DUE: All tasks must be completed by ___________

Evaluation :

1.	Problem solving sheet	40%
2.	Efficiency score	40%
3.	Work log	10%
4.	Co-operation & Safety	10%

TOTAL POSSIBLE POINTS _______________

Riverside Technology Activity Technology Education

Title: Wind Powered Cars

Type: Transportation

Problem Brief:

Design and build a wind powered vehicle using any approved material you wish. The Vehicle will be required to fit inside a box 8" wide, 15" high, and 12" long. You may use approved material from home or school.

Goal:

Build a wind powered car to go far and straight.

Requirements & Limitations:

1. An acceptable sketch of the car must accompany your car (Important).
2. No Legos

Evaluation :

A 20" box fan will be used to power the vehicle. The car should go straight. The distance off the track will be subtracted from your total score.

Grade: Your grade will be determined by how each vehicle finishes, loosing 1% point for each place. The lowest grade for a completed car is 80%; 1st = 100%, 2nd = 99%, 3rd = 98%, and so forth.

Suggestions:

1. How is a sailboat powered.
2. Get your ideas down on paper and tested as many times as you can. You will improve your car each time you redesign.

Riverside Technology Activity Technology Education

Title: Metric 500 Design

Type: Primary

Problem Brief:

The engineering firm you work for has been asked to design a race car for the prestigious Metric 500. Your firm is new and would profit considerably if its design could win the race.

Goal:

Using the rule book provided, design and build a prototype car, to win the Metric 500. The design should be fast and look good.

Requirements & Limitations:

1. A design portfolio must be complete before you begin making your prototype.
2. Material will be provided. You may use other material with special written permission.
3. Car must be built using the specifications provided. Any deviation will hurt your grade.
4. Redesign can take place during class, after school, or during study hall.
5. Students work in teams of two to four people.
6. A print out of a car built on Car Builder should be included in design portfolio.
7. All reading and written assignment in wind Tunnel should be included in your design portfolio.

DATE DUE: All tasks must be completed and ready for grading by _______

Evaluation :

1.	Design portfolio	50%
2.	Completed prototype	40%
3.	Co-operation & Safety	10%

TOTAL POSSIBLE POINTS________________

Riverside Technology Activity Technology Education

Title: Robotics 2000 Inc.

Type: Primary

Problem Brief:

A well known bakery has decided to invest some money automating their plants. Our company, Robotics 2000 Inc. has been awarded a contract to build a prototype for them. The best prototype will be awarded a multi-million dollar contract to modernize their facility.

Goal:

Design a fluid powered robotic arm capable of pouring liquid from a 4 oz. container (approx.) into an assigned bowl. The accuracy of the pour is important.

Requirements & Limitations:

1. The design portfolio must be completed before you begin building your robotic arm.
2. Tech competencies must be passed before you begin your proto-type.
3. All robotics/fluid power handouts must be reviewed and reading assignments completed.
4. The fluid power will be an hydraulic system consisting of water and syringes.
5. The robot will include the following mechanical movements and dimensions:
   a. an arm sweep of at least "
   b. a shoulder swivel of at least
   c. a gripper that opens at least
   d. a device to roll the gripper at least degrees
6. Any material may be used to build the robot. However the best materials are wood, metal and plastic.
7. Each student will work with one or more students to accomplish the task.

DATE DUE: All tasks must be completed and ready to demonstrate by ________

Evaluation:

1.	Design portfolio	40%
2.	Demonstration	40% (5 min.)
3.	Work log	10%
4.	Co-operation & Safety	10%

TOTAL POSSIBLE POINTS ____________________

72

Riverside Technology Activity Technology Education

Title: Ocean Recovery Vehicle

Type: Primary

Problem Brief:

Design a vehicle to recover objects from a sunken ship.

Goal:

1. Research and find the name of a sunken ship (1 written or typed page).
2. Submit a map identifying the location of the ship (latitude, longitude, depth, and so forth).
3. Identify the object(s) you will be recovering.
4. Develop an appropriate design.

Requirements & Limitations:

1. Students will work individually.
2. You should get permission for the appropriate authority before cutting anything from any catalog, magazine, newspaper, etc..
3. Computers are available in the Tech lab.. Pass is required.
4. A finished draft of the vehicle on CADKEY with dimensions is required.

DATE DUE: All tasks must be completed and ready for grading by ________

Evaluation:

1.	Design	35%
2.	CADKEY Drawing	35%
3.	Paper	20%
4.	Co-operation & Safety	10%

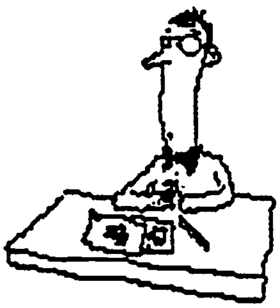
TOTAL POSSIBLE POINTS ____________________

Nathaniel Hawthorne Intermediate School 74
Department of Technology

Communication Technology - Mr. M. Kittenplan

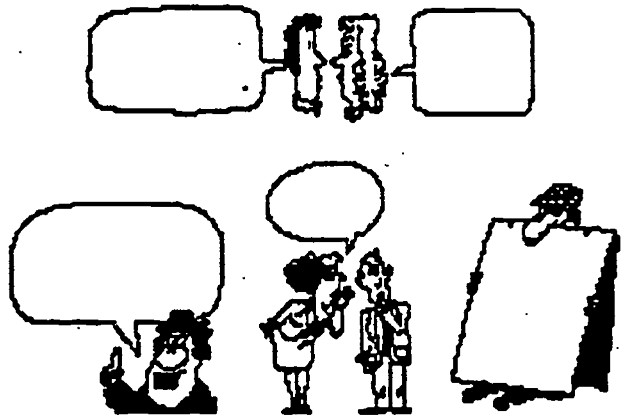
DEVELOPING AND COMMUNICATING IDEAS

A designers job is to work out the best way of doing or making something. Designers will have some initial ideas but these have to be improved or developed. Of course their ideas are no good locked away in their heads. They have to explain their ideas to other people. This is called communicating design ideas. There are many ways that designers develop and communicate their ideas. Sometimes designers will use several methods in one project. Here are the 4 main ways to develop and communicate ideas:



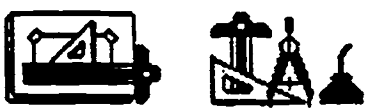
SKETCHES

Sketches are simple drawings which explain the basic idea. They might include some useful notes and a little bit of color. Sketches are a quick way of sorting out your different ideas. This is especially useful at the beginning of a project.



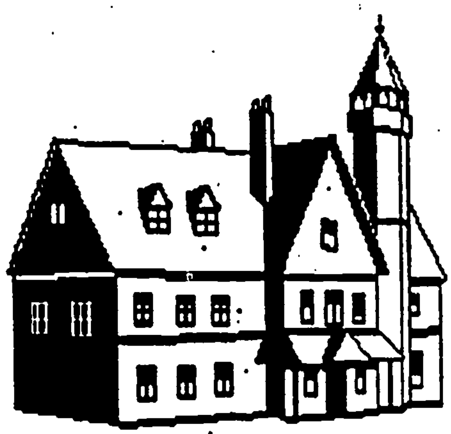
STORYBOARDS

Storyboards are a series of pictures and words which explain a sequence of events. They work like a cartoon strip. You might use storyboards to design a system like a production line, a video or an animation.



SCALE DRAWINGS

Scale drawings are very carefully drawn plans of objects. They show all the sizes, the materials and the way they are joined together. It is only worth making a scale drawing once you are absolutely clear about the product that you are designing.



MODELS

Sometimes it is hard to work out or explain an idea by drawing it. It may be easier to make a simple model or a mock -up. A few notes might help your explanation

Technology Seminar - Design Brief
A Million Pennies

Context

Our class has been hired by an outside firm to produce a storage container for the collection and display of one million pennies. As happens very often in the "real world" the customer wants the product and service yesterday. In these times of recession we need this work so we will do whatever we have to do to get the job done. We need to keep our costs as low as possible, but still deliver a quality product.

Problem Statement

Design and construct a storage container for one million pennies.

Criteria

[What has to be done] This storage device must:

- --> hold a million pennies
- --> be safe (small children will be using it)
- --> be fun and creative
- --> have a way to check progress of the collection
- --> protect the collected and stored pennies from theft
- --> have a way of making sure the distribution of the pennies is even
- --> not damage the floor on which it will rest
- --> have a way of putting in one penny at a time or many pennies at once
- --> allow for each person on the problem-solving team to learn the basics of the creative problem solving process as this problem is solved
- --> have an easy way of getting the pennies out

Limitations

[The restrictions we have]

- --> maximum live load = 700 lbs./ft^2 [originally 90 lbs./ft^2]
- --> to be built as quickly as we can while still learning the creative process
- --> two people must be able to lift it onto a pickup truck when it is empty
- --> cost must stay under $ 75.00.

Resources

[What we can use to accomplish this job.]

- --> Mr. Queior as a liason with the client
- --> Creativity, Design & Technology textbook on the creative process
- --> Library, math and physics textbooks, etc.
- --> computers/calculators, etc.
- --> production technology equipment

Evaluation

- --> 50 % meeting the criteria [All design team members share this grade]
- --> 50 % technology research & design analysis report

Advertisement - Design Brief

Publishing Technology

Context:

The Technoogy Education Department is being developed to be a resource for students, staff and the community. In order to make the changes necessary and to help others make use of our staff and facility we need to make others aware of what is available in the form of resources (i.e. people and their skills, equipment, software, facilities, etc.)

Problem Statement:

Create an advertisement that communicates the present and planned resources available through the high school Technology Education program.

Criteria:

--> one side of colored, legal size(8.5" by 14"), bond paper
--> graphics must include: one (or more)digital photograph, one (or more) graphic from the "blue disks", and use of the tool box.
--> styles must be defined before entering any text - including: headline, caption, body text and one subhead
--> there must be at least one line art drawing from hypercard, "clip art" disks or drawn using a paint program like Superpaint or the Microsoft Works toolbox.
--> laserprinted

Limitations:

--> Pencil draft is due on Monday, March 23
--> Final laserprinted copy on colored paper is due Friday, March 27

Resources:

--> The Mac Lab
--> Technology Lab #2
--> Design books

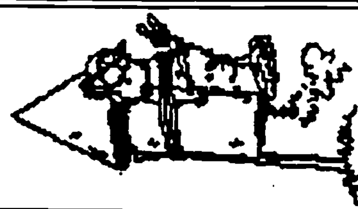
"Technology on track"
Technology Education is the study of the human-made world. What's going to happen if we don't study the impact of our "inventions"?

Hawthorne Technology

Nathaniel Hawthorne Intermediate School 74
Department of Technology

Communication Technology - Mr. M. Kittenplan

Assignment:
INTERNATIONAL LANGUAGE
Logos, Pictographs and Icons



SETTING THE STAGE

You are the Business Manager of a large firm that manufactures watches that are sold all over the world. A set of instructions printed in various languages is included with each watch. You could save the company a lot of money and possibly earn yourself a large pay raise if you could devise a small pamphlet containing pictured instructions to be understood by everyone. This pamphlet could be included with every watch, saving the company so many different printings.

YOUR CHALLENGE

Using the international language of pictures, assemble a booklet of directions for an activity of your choosing.

PROCEDURE

1. Study examples of picture directions, as discussed and seen in class.
2. Look for directions that come with purchases and bring in examples of picture directions. For example, these might include how to install a VCR. Share these picture directions and build a file for later use in the classroom.
3. Assemble a list of examples of international symbols used to provide information. These will help you when you begin your task.
4. Choose a procedure that you are familiar with. Outline the procedure in writing. Use short sentences. Your procedure should reflect safety in each step.
5. Your outline may be long. Now you must begin to see how many ideas can be presented in one drawing. "One picture is worth 1000 words." Group the ideas you would like presented in each drawing.
6. Produce your first picture using drawings, photos, cut-out pictures, etc. and have the class interpret it. Use feedback they give you to modify and change areAs that are not clear. Color can be added to emphasize important points.
7. Repeat step #6 until you have finished describing how to do the activity.
8. Check your booklet by having another student write a set of directions while he or she looks at your picture directions.

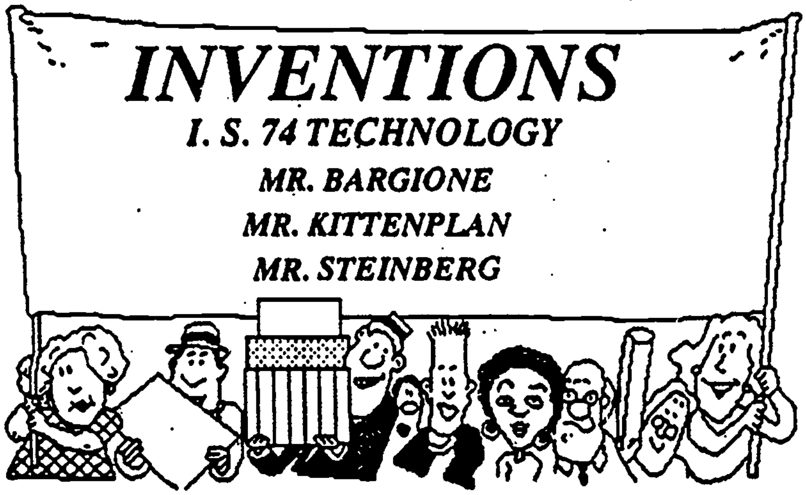
SUMMARY

Communication includes having a message sent, received and understood. The communications process consists of some sort of a transmitter, a channel over which the message travels, and a receiver. In this activity, what is the transmitter? The channel? The receiver? What purpose (inform, educate, persuade, entertain or control) does your communication system accomplish?

77

Nathaniel Hawthorne Intermediate School 74
Department of Technology

Communication Technology - Mr. M. Kittenplan



You are asked to DESIGN and CONSTRUCT some type of invention.....It may be a tool, a gadget or an improvement on an invention that already exists.

This invention may be a way to do something better.....or faster.....or easier. It may solve a problem. It may be a toy.....a game.....a sport or leisure time item.....something new for the home.....BE CREATIVE!!!

Accompanying the completed invention will be a written report. This report is to include <u>ALL</u> of the following information:

1. A cover, with the title of the invention, your name, your class and any decoration that you choose.
2. A picture and/or diagram of the invention.
3. A list of materials used to construct your invention.
4. In your own words, state the problem that your invention deals with.
5. An explanation of how your invention works to solve the problem.
6. An explanation of the advantages of your invention.
7. An explanation of any disadvantages connected with your invention.
8. An explanation of the environmental soundness of your invention (Is it ecologically sound sound? Does it create pollution? etc.).
9. Provide a DETAILED DESCRIPTION of how your invention works.
10. Any other pertinent notes or information.

Your grade will reflect 1) the finished invention 2) the written report and 3) an oral presentation of your invention.

High School Technology Education
Suggested Idea-Activity Outline

Contributor Charles Catarelli

School Elmont Memorial High School
Elmont, NY

Check appropriate course

____ Production
__X__ Transportation
____ Communication
__X__ Tech. Drawing
____ Electronic/Electricity
____ Energy

Title: "Flight of Fancy": Paper Glider Design Competition

Overview/Description

Design a paper glider using known criteria for achieving flight. Construct a stiff paper model and test for length and duration of flight. Redesign and compete with fellow students.

Problem Statement

Design a paper glider that will have a long distance, or long duration, flight.

Activities

1. Design sketches.
2. Technical drawing of design.
3. Test flight.
4. Redesign.
5. Competition.

Sample Topics

1. Air foil and basics of flight
2. Variables of flight performance
3. Using proportion and math variables

References

Whitewings, AG Co. Ltd., Yodogawa-Ku, Osaka, Japan.

Resource Contacts

Charles Catarelli, Elmont Memorial High Schol

Related Technology Applications (cross over areas)

Transportation, (Physical) Tech.

Recommended Facility: Mechanical Drawing Room and Outdoor Area (or gym)

TECHNOLOGY LEARNING ACTIVITY

"THE SCAMBLER"

INTRODUCTION

This activity presents the opportunity for students to explore and develop their design capabilities as they pertain to technology education.

TEACHING OBJECTIVE

To design and develop a solution to safely transport an exposed egg as quickly as possible, exactly ten yards using only the kinetic energy of a falling brick.

TOOLS AND MATERIALS

No limit to specific material types to be used, however they may not exceed a $30.00 cost value. No restriction on relative tools, hand tools as well as power tools are permitted.

INTERDISCIPLINARY LINKAGES

MATH - calculations, weights and measures.
Science - speed, distance, action-reaction, use of gravitational force and strength of materials.
Human and social - cooperative learning and communication of technical ideas.

EVALUATION

40 Points - Presentation, each team will present their design solution, demonstrating relative steps to achieve the objective. A portfolio must be submitted containing written problems, device sketches, any relative calculations, and a list of materials used.

40 Points - Demonstration requirements - scores calculated by adding time in motion to distance the front of the egg stops from the finish line. Every inch beyond the finish line will be penalized by a factor of two. Disqualification results if the egg is damaged, the vehicle crosses a boundary line, or the 5 minute time frame is exceeded.

20 Points - Daily grades will be earned for individual participation during lab time.

REFERENCES / RESOURCES

TEACHING NOTES

This particular lesson represents a TLA undertaken by eighth graders. The use of this activity allows students an open-ended design opportunity.

High School Technology Education
Suggested Idea-Activity Outline

Contributor M. H. Kleinbach

School SUNYCO
Oswego, NY 13126

Check appropriate course

____ Production
____ Transportation
____ Communication
____ Tech. Drawing
____ Electronic/Electricity
__X__ Energy

Title: Simplified BioGas Generation

Overview/Description

Biogas is produced when animal waste products are allowed to decompose in an airless environment. The process takes place with the aid of anerobic bacteria. Biogas is methane plus a small amount of other gases such as hydrogen sulfide and carbon dioxide.

Problem Statement

Students will plan and construct a simple biogas generator. Caution! Biogas will burn and can explode if the air/gas mixture is between 5 and 14%; it is lighter than air and will rise in an enclosed area.

Activities

1. Determine quantity of animal waste to be used and amount of methane expected to be generated.
2. Design and construct biogas generator and collection tank.
3. Construct devices to remove hydrogen sulfide and carbon dioxide from gas produced.
4. Use methane generated to operate an engine or light a burner.
5. Measure the Btu content of the gas generated.

Sample Topics

1. Energy conversion
2. Safety in use of fuels

References

Auerbach, Les. A Homesite Power Unit: Methane Generator. 242 Copse Road, Madison, CT 06443.
Meynell, Peter-John. Methane: Planning a Digester. Schocken Books, New York, NY, 1976.

Resource Contacts

Carlton Salvagin, SUNYCO, Oswego, NY 13126.

Related Technology Applications (cross over areas)

Transportation

Recommended Facility: Energy lab, Transportation lab, Outside

TECHNOLOGY LEARNING ACTIVIT

PING PONG CANNON

PROBLEM STATEMENT:
USING SUPPLIED "CANNON BARREL" AND PING PONG BALL, REMOVE PING PONG BALL FRO CANNON WITHOUT PHYSICALLY MOVING "CANNON BARREL" FROM THE UPRIGHT POSITION ON FLOOR.

PROCEDURE:
INSTRUCTOR PLACES PING PONG BALL IN CANNON, TEAM MUST REMOVE IT FOLLOWING ABOVE STATEMENT.

TECHNOLOGY EDUCATION PONAGANSET

TECHNOLOGY LEARNING ACTIVIT

SATELLITE COMMUNICATIONS

PROBLEM STATEMENT:
TRANSMIT AND RECEIVE MESSAGES VIA SIMULATED SATELLITE SYSTEM.

PROCEDURE:
USING MEGA TECH SATELLITE EXPERIMENT STATION AND AND EXPLANATION SHEET.
TRANSMIT AND RECORD VOICE VIA TEST SATELLITE.

TECHNOLOGY EDUCATION PONAGANSET

TECHNOLOGY LEARNING ACTIVITY

TRACTOR PULL - TUG/OF/WAR

PROBLEM STATEMENT
DESIGN A VEHICLE USING LEGO COMPONENTS THAT WILL COMPETE AGAINST ANOTHER VEHICLE IN A TUG/OF/WAR EVENT

THE VEHICLE PULLING THE OTHER OFF CENTER THE FURTHEST IS THE WINNER

PROCEDURE:
TEAMS OF TWO OR THREE.
ONE LEGO TECHNICS II KIT PER TEAM.
BATTERY PACK DOES NOT HAVE TO TO BE PART OF TRACTOR.

TECHNOLOGY LEARNING ACTIVITY

THE BRICK TOWER

PROBLEM STATMENT
DESIGN A TOWER THAT WILL SUPPORT A COMMON BRICK

THE TALLEST TOWER IS THE WINNING DESIGN

THE MATERIAL SUPPLIED FOR THE TOWER

12-5 X 8 INDEX CARDS
MASKING TAPE
STAPLER
COMMON RED BRICK

TECHNOLOGY LEARNING ACTIVITY

LUNAR LANDER
(PASSENGER: EGG)

PROBLEM STATEMENT:
DESIGN AND DEVELOP A DEVICE THAT WILL SAFELY TRANSPORT A PASSENGER. THE DEVICE WILL BE LAUNCHED FROM A MINIMUM HEIGHT OF TWELVE FEET.

PROCEDURE:
DEVICE IS CONSTRUCTED FROM 576 SQ. INCHES OF PAPER ONLY
ANY TYPE OF CEMENT OR GLUE CAN BE USED.HOWEVER NO FORMED CONTAINERS CONSTRUCTED EXCEPT BY STUDENTS WILL BE ACCEPTED

86

TECHNOLOGY LEARNING ACTIVITY

FOAM PLANES

PROBLEM STATMENT:
DESIGN AND CONSTRUCT A STYROFOAM GLIDER FROM RECYCLED, OR REUSED MATERIALS

PROCEDURE:
EACH STUDENT WILL CHOOSE TO COMPETE IN DURATION, DISTANCE, OR ACROBATICS AND BE GIVEN THREE FLIGHTS OF THEIR CRAFT. THE TOTAL FLIGHT TIME, TOTAL NUMBER OF LOOPS, AND THE DISTANCE OF EACH FLIGHT WILL BE RECORDED.

87

APPENDIX A

Understanding the Change Process

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In 1947, during a presentation entitled "A Curriculum to Reflect Technology," Dr. W. E. Warner, then of The Ohio State University, proposed new content organizers for industrial arts (i.e., manufacturing, construction, communication, transportation, and energy). Interesting isn't it that many, if not most, of the professional in the field consider the current national transition from metals, woods, drafting, electricity/electronics, and graphic arts (i.e., industrial arts) to production, transportation, and communications (i.e., technology education) as a recent innovation.

However, in the almost fifty years since Warner's proposal, changes have taken place. The American Industrial Arts Association is now the International Technology Education Association. Most, if not all, state associations have changed their names to technology education. State Departments of Education have endorsed technology education as the official title of the discipline with regard to curriculum and certification. In addition, a significant percentage of programs at the secondary and teacher education levels have also changed their name, curriculum, facilities, and instructional activities. However, for a variety of reasons, we still have a very long way to go. Consequently, it is appropriate as those within the field try to affect change to have a better understanding of the change process. The following is an attempt to synthesize a significant amount of research literature regarding how change occurs within educational institutions, other organizations, and within individuals.

Literature Review

Change is a developmental process, not an event (Foster, 1989; Fullan, 1982; Hall & Hord, 1987; Hall, Loucks, Rutherford, and Newlove, 1975; Havelock, 1973; Rogers, 1983). While there is a great deal of diversity among the change theories, there is also a great deal of similarity in the lists of stages/phases offered by the various researchers. A generic list of stages would include (a) becoming aware of the innovation, (b) gathering information, (c) deciding to implement, (d) implementation, and (e) evaluation.

Rogers' Diffusion of Innovation Theory

Rogers (1983) has advanced one of the most comprehensive theories regarding the adoption of technological innovations. Rogers contends that change is a developmental process. The approach taken by Rogers, and most of the other change theorists, is a sociological one, a sort of "macro perspective to the change process. This perspective is analogous to studying the effects of dropping a rock in a puddle of water. One would be concerned with the (a) factors that controlled the speed of the ripples, (b) characteristics of the water, and (c) characteristics of the rock (e.g., size, shape, and how it was thrown). Similarly, the macro perspective focuses on the nature of the innovation (the rock), the nature of the system or individual adopting the innovation (the water), and the factors affecting the degree and rate of change (the factors). Each component in the system impacts the speed at which the innovation is implemented (adopted).

According to Rogers, the innovation-decision process begins with knowledge of an innovation (i.e., becoming aware an innovation exists and learning how the it works). The process continues as the individual forms an attitude toward the innovation (persuasion). Based on this attitude, the person makes a decision to either adopt or reject the innovation. If the person decides in favor of the innovation, he or she enters the implementation stage. During this stage, the individual learns how to use the innovation, develops expertise, and possibly alters some aspects of the innovation (re-invention). The implementation stage ends when the innovation is institutionalized by the organization or becomes a matter of routine for the individual. For some individuals this ends the innovation decision process, but others enter the confirmation stage. The confirmation stage consists of gathering follow-up information that either supports the decision to adopt the innovation or causes the individual to discontinue using the innovation.

During the persuasion stage, Rogers argues that the person is influenced by five characteristics of the innovation:

1. Relative advantage - the degree to which an innovation is better than existing practices or products. Innovations that allow a task to be completed easier, quicker, or cheaper are more likely to be adopted.

2. Complexity - a complex innovation will diffuse through a system slower than a simpler one. In the case of computers, the initial microcomputers required a great deal of complex programming which tended to prevent many people from using them. Today, improvements in the technology have made microcomputers much more "user-friendly."

3. Observability - innovations with observable results are more likely to be adopted. Those innovations which have observable, positive results will diffuse the quickest.

4. Trialability - the rate of adoption will improve if an innovation can be tried out on a limited basis.

5. Compatibility - the degree to which an innovation is compatible with existing practices, policies, beliefs, and needs of the group or individual. This variable seems particularly relevant to the transition from industrial arts to technology education. Teachers are likely to resist this innovation because it is inconsistent with their perceptions of themselves, their role, and their perception of the needs of students.

Rogers theorized that the adoption of any innovation is also partly controlled by the characteristics of the members of the system. Rogers identified five categories of adopters based on individual demographics (i.e., education level, social status, and mobility) and their willingness to adopt the innovation. The categories include (a) innovators, (b) early adopters, (c) early majority, (d) late majority, and (e) laggards (see Figure 1).

Innovators are usually the first to adopt an innovation. This group is made up of individuals who, for the most part, have a higher income, are better educated, travel more, and read more than the rest of the community. They have a reputation for "always trying something new" and have the resources and desire to do so. Consequently, they tend to be outside the mainstream of the community. Early adopters employ an innovation quite early and have many of the same characteristics, but unlike innovators, early adopters are more cautious, and are looked to by the rest of the community as a primary source of accurate information. Following these two groups are the early and late majority which make up approximately 68 % of the population. These two groups tend to adopt the innovation an average of ten years after it has been introduced. The final group, laggards, tends to be very suspicious of a change and will adopt an innovation only after it becomes an economic necessity.

The rate of adoption can be improved through the efforts of a change agent and opinion leaders (Rogers, 1983). Change agents are individuals employed to introduce an innovation into a system and to provide technical assistance. An agriculture extension agent employed by the United States Department of Agriculture is a classic example of a change agent. For decades, the Department of Agriculture has employed individuals to disseminate research information and to assist farmers during the awareness, persuasion, and implementation stages of an innovation-decision process.

Opinion leaders are members of the community into which the innovation is introduced. These individuals are highly respected by many of the other members of the community and can greatly influence the other members to adopt the innovation. Generally, a change agent is wise to expend the greatest amount of energy convincing opinion leaders to adopt an innovation and let them convince the rest of the community.

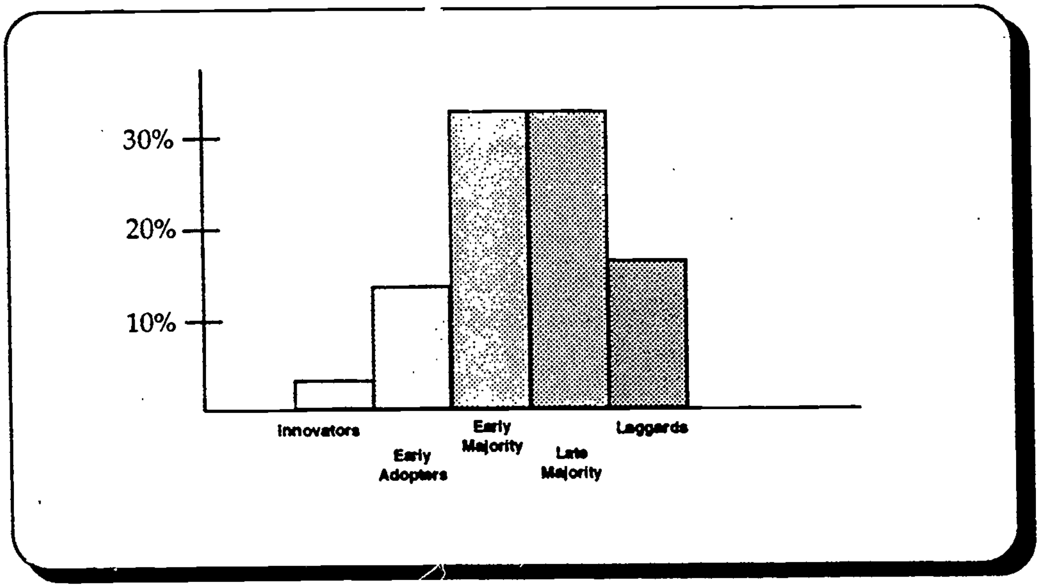

Figure 1. Roger's categories of adopters.

Concerns-Based Adoption Model

Hall et al. (1975), and, more recently, Hall and Hord (1987), have advanced a developmental model of innovation adoption in educational institutions called the Concerns-Based Adoption Model (CBAM). Their research represents some of the early change research that focuses on the adoption of innovations from an individual's perspective. A fundamental claim of their research is that change is not accomplished in fact just because a decision maker has announced it. Instead, the various members of a user system, such as teachers and professors, demonstrate a wide variation in the type and degree of their use of an innovation. One of the reasons for this variation is the commonly overlooked fact that change is a process rather than a decision-point — a process that each person experiences individually (Hall & Hord,1987, p. 5).

In their 1987, Hall and Hord contend that an individual mentally goes through seven "Stages of Concern About an Innovation" (SoC) and behaviorally goes through eight "Levels of Use of an Innovation" (LoU). These two lists are summarized in Figure 2, but should not be viewed as occurring simultaneously.

It seems logical to assume that each stage of concern occurs simultaneously with the corresponding level of use. And, to some extent, research to date has suggested that this may be true at the beginning and end of the process (G E. Hall, personal communications, April 1988). However, the research has also shown that individuals tend to have multiple concerns of varying magnitude for each level of use. As individuals move through the levels of use, it is possible to see a general progression through the stages of concern and a trend from the lower

Stages of Concern		Levels of Use	
0	Awareness	0	Nonuse
1	Informational	I	Orientation
2	Personal	II	Preparation
3	Management	III	Mechanical Use
4	Consequence	IVa	Routine Use
		IVb	Refinement
5	Collaboration	V	Integration
6	Refocusing	VI	Renewal

Figure 2. Hall and Hord's Stages of Concern (SoC) and Levels of Use (LoU).

concerns to the higher ones (Hall, George, & Rutherford, 1979; Loucks & Hall, 1977; Wedman & Heller, 1984). However, at any one level of use, individuals usually manifest multiple concerns.

Those attempting to facilitate the change process in educational institutions will be most effective if the concerns of teachers are taken into consideration (Hall & Hord, 1987; Wedman & Heller, 1984). Teachers who are at the awareness stage of concern will be less receptive to technical information. During the awareness stage, teachers need to know what the innovation is and how it will benefit them. In the case of technology education, it would be more appropriate to try to get teachers in the awareness stage excited about the benefits for them if they make the transition (e.g., increased personal excitement, greater job satisfaction, increase enrollments, increased approval from the administration).

Change as a Multi-Dimensional Process

In contrast to theories of change which tend to view it as a linear, one-dimensional, rational process, Fullan (1982) argues that change is always multi-dimensional. Fullan (1982) draws attention to the meaning of educational change (i.e., the objective realities of the innovation and the subjective realities for the individual). Unfortunately, the former realities (i.e., logistical and hardware/software concerns) receive the greatest attention in educational institutions. In order to understand and facilitate educational change one must consider these realities at every stage of the change process.

Fullan (1982) contends that three aspects of the subjective reality of change for the teacher must be taken into account before and during the change process. First, the typical situation of teachers or anyone else in ongoing organizations is one of fixity and a welter of forces keeping things that way. Second, there is little room, so to speak, for change. When change is imposed from outside, it is bitterly resented. When it is voluntarily engaged in, it is threatening and confusing . . . Third, there is a strong tendency for people to adjust to the "near occasion" of change, by changing as little as possible - either assimilating or abandoning changes which they have initially been willing to try, or fighting, or ignoring imposed change (p. 29).

Resistance to Change

Referring back to Rogers' (1983) categories of adopters, one can see that approximately 84% of a given population will resist an innovation when they first learn of it. Dealing specifically with organizational change, Caruth, Middlebrook, and Rachel (1985) argue that people tend to resist change for two general reasons. First, it is human nature to resist or oppose anything that will be troublesome, uncomfortable, or inconvenient. Second, people are often fearful of what the change might do to them. They fear what is unknown, losing job security and job status, suffering economically, or changes in social relationships. To fully understand this phenomena, the following (See Figure 3) is offered as a model of the change process viewed from the perspective of the individual who is deciding whether or not to change.

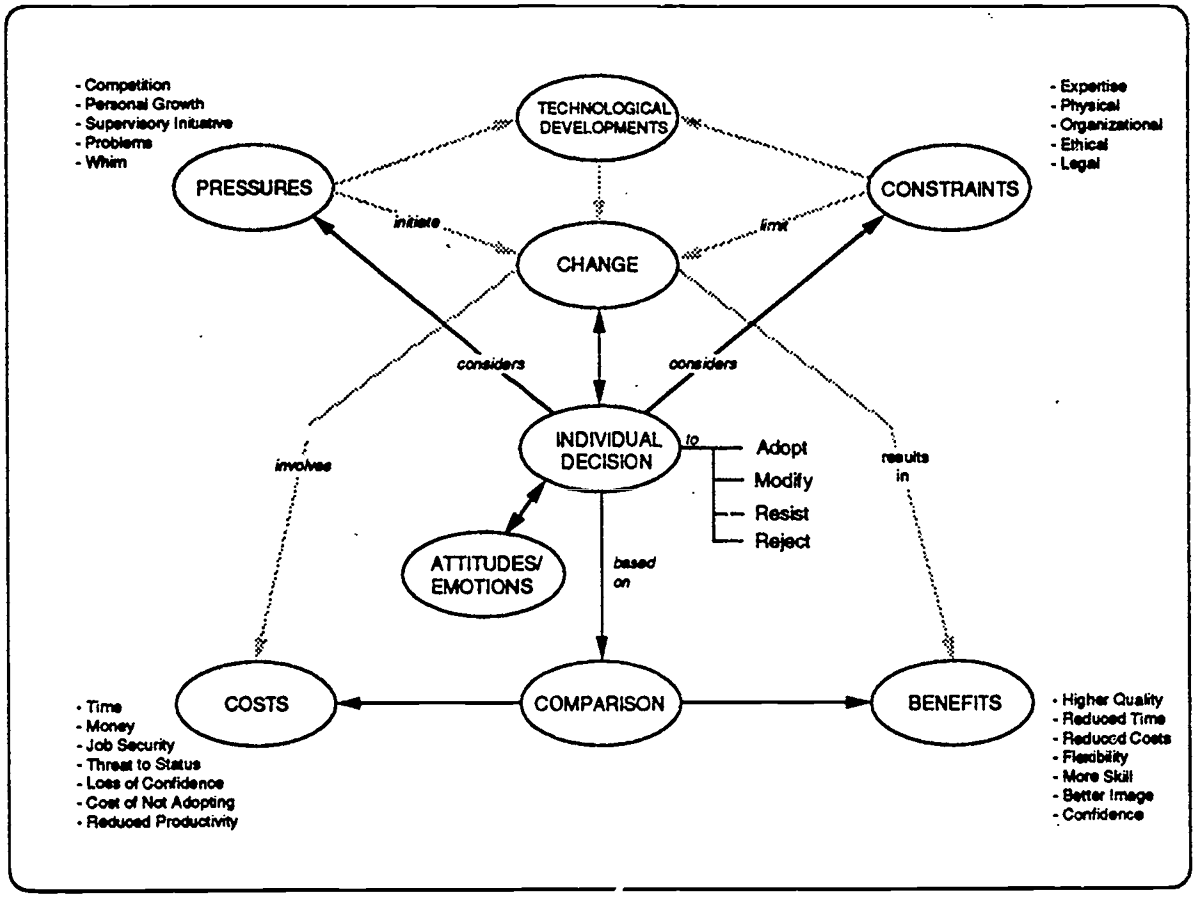

Figure 3. Foster's (1993) Model of an Individual's Decision-Making Process when Confronted with the Opportunity To Change.

Basically a conceptual map[1], this model is the result of an attempt to integrate the findings of organizational change, diffusion of innovations, and educational change research with what is known about human decision making processes. As previously stated, regardless of the source of a change or the need for it, in the final analysis, it is the individual who must decide to use, modify, resist, or reject the innovation.

According to this model certain pressures and technological innovations bring about a change situation. The ability to change is limited, to some extent, by various constraints. At some point, the individual becomes aware of the innovation or is informed that he/she must change. If we accept that change is almost always a developmental process, after becoming aware of the change, the individual would begin to gather information about the innovation. During this stage, the individual analyzes the change, compares the costs to the benefits, and develops an attitude toward the change. This process is contingent, to some degree, on previous experiences, existing attitudes, and the individual's emotional state. For example, the person may dislike the individual who informs him/her of the innovation. Or perhaps, the person has had a negative experience with some aspect of the innovation or with a similar innovations. The creation of a negative attitude will adversely affect the individual's decision-making process regarding the innovation.

Based on this analysis, the individual decides whether to adopt, modify, resist, or reject the innovation. In most cases, the individual will conclude that the costs outweigh the benefits, and will react negatively to the innovation. This may be because the costs are usually paid by the individual but the benefits, which are promises at best, are often realized by others (the institution, students, parents, and society).

For example, why might a teacher resist transitioning to technology education? First the costs (e.g., rewriting all lesson plans, redoing instructional materials, lack of personal confidence with newer technologies, training costs, expenditures of time and emotional energy, frustration, and potential loss of status) are high and paid by, to a large extent, by the teacher. On the other hand, the benefits may be perceived to be much lower than the costs. This is primarily because students, parents, the institution, and society are perceived by the teacher as the primary beneficiaries of the teacher's efforts. Whereas most teachers are very dedicated, hard-working professionals, they are also very busy and usually very practical people who like to see a significant return for their efforts.

As time goes on, developmental change research indicates that more and more people will adopt the innovation, however, initially the individual usually decides to resist using the innovation.

Realizing the Potential

A major confounding variable which slows the diffusion of any innovation is the nature of the innovation itself. Remembering back to when the first microcomputers appeared in secondary schools, they were primarily used by mathematics teachers for teaching programming. Later as software became available, business educators became involved. Primarily the use of the microcomputer at that stage was to prepare students for computer occupations.

Shortly thereafter, other educators began to see how the microcomputer could help them do their jobs better and easier. For example, coaches used spreadsheets for team statistics, others recorded and calculated students' grades, and many began using word processing to create instructional materials and write examinations. Even with the proliferation of educational software, the primary uses of the microcomputer by teachers was and still is to complete personal tasks (Foster, 1989).

Today, the innovation has changed significantly. The increased power of the microcomputer, the development of new hardware and sophisticated software, and the reduction in costs has made computer-aided and computer delivered instruction a real possibility.

The same can be said of the transition to technology education. As a field we still have not come to agreement on what technology education is all about. A multitude of opinions vie for attention. In addition, the availability of quality instructional materials is still somewhat limited and difficult to use given the levels of expertise possessed by teachers who were trained in industrial arts. However, given all the constraints, a great deal can be done to facilitate the change process.

Recommendations

To help overcome these and other problems, the following recommendations are made to improve practice:

1. Ensure that the innovation is clearly defined and that the innovation is initially described in terms of the benefits of using the innovation.
2. Carefully plan the implementation of the innovation. Ensure that adequate time, resources, training, and money are available. Release time is needed to allow teachers to gain expertise and develop materials.
3. Given that all changes take a great deal of time, ensure that the change effort is sustained. Work to maintain interest and excitement. All new ideas need a champion.
4. Whenever possible let those who will use the innovation be involved in the decision-making, planning, and implementation.
5. Keep everyone informed. Don't let rumors kill a good idea.
6. Provide positive examples of the innovation and role models for the teachers.
7. Reward effort and success. Use the in-house and public media to highlight achievements.
8. Introduce change slowly. "Work the bugs out" on a small scale before undertaking a large project.
9. Innovations which have a "champion" (i.e., someone who is very eager to see the project completed successfully and who will work to ensure that things proceed) have the greatest likelihood of success. Use the early adopters in your school to teach and assist others. Seek outside assistance when appropriate.
10. Provide administrative support. Innovations which are a priority and have administrative support are more likely to be adopted and the time needed will be reduced.
11. Leaders, in collaboration with those who will do the changing, should establish and consistently communicate the vision.

Stated differently, resistance to change will be less if:

- the teachers feel that the project is their own - not devised and operated by outsiders;
- the project clearly has wholehearted support from top officials of the system;
- participants see the change as reducing rather than increasing their present burdens;
- the project accords with values and ideas which have long been acknowledged by participants;
- the program offers the kind of new experience which interests participants;
- participants feel that their autonomy and their security is not threatened;
- participants have joined in diagnostic efforts leading them to agree on what the basic

problem is and to feel its importance;

- the project is adopted by consensus group decision;
- proponents are able to emphasize with opponents, to recognize valid objections, and to take steps to relieve unnecessary fears;
- it is recognized that innovations are likely to be misunderstood and misinterpreted, and if provision is made for feedback of perceptions of the project and for further clarification as needed;
- participants experience acceptance, support, trust, and confidence in their relations with one another;
- and the project is kept open to revision and reconsideration if experience indicates that changes would be desirable.

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Footnotes

1 A conceptual map is a tool developed by cognitive psychologist as a means of representing one's understanding of a concept. The map is constructed by listing the components of the concepts, then drawing a model which represents the interrelationship of the components. Finally, brief explanations of the interrelationships between components are listed on the lines connecting the components.

2 This is not to ignore the fact that most school districts and colleges/universities for that matter, have not been able or willing to make the major investment of time, resources, and money needed to use educational technology to its fullest extent. Even when districts do make the investment, the reaction of the faculty has been disappointing (See Foster (1989) for a description of three innovative high schools or high school districts in Illinois).

APPENDIX B

NETEC Article Published in *TIES* Magazine

May/June 1993

NETEC

The Northeast Technology Education Consortium

The Northeast Technology Education Consortium (NETEC) includes five school districts, several colleges and the education departments in the six New England states and New York. The Consortium was funded as a National Demonstration Site for Technology Education by a U.S. Office of Education Grant. The grant's major focus was on the integration of math, science and technology education; however, it provided a major impetus for upgrading the facilities in all five of the NETEC sites.

SOUTH PORTLAND, ME
A Catalyst for Change

by Robert W. Nannay

In 1990, South Portland High School was selected to participate in the Northeast Technology Education Consortium (NETEC). South Portland's NETEC site has experienced a roller coaster ride in its development. At the outset, there were a number of barriers to programmatic implementation — an old school, a curriculum emphasis geared toward the academically talented youngster, and "unit" shops designed for a range of traditional programs. The school is located in a community which has experienced economic problems in recent years.

Robert W. Nannay is NETEC Consultant and Coordinator of Technology Education, Department of Technology, University of Southern Maine.

The Transition Process

After reviewing curriculum materials from around the country, South Portland faculty developed a new program around the recently published Maine State Technology Education Curriculum Guide, which stresses foundational principles of technology education and activities in production, energy, transportation, and communications.

To develop community support, a public relations and education program was launched, with emphasis on the excellent opportunites provided by the NETEC Project and its federal support.

Designing the Facilities: Vision...and Reality

With the curriculum planning and PR effort well underway, attention was turned to the issue of facility design. South Portland's dwindling industrial arts program left the NETEC project with the challenge of designing a model Technology Education program in a facility that had been reduced to two shops and an adjoining classroom.

The technology faculty adopted a bold initiative: to design a totally new wing to support their innovative program. Outstanding help and advice was provided by the architectural firm of Kaestle Boos Associates from New Britain, Connecticut. The company donated their time and expertise to NETEC and designed a beautiful new facility. The Kaestle Boos plan featured a dramatic exhibition area, the "Hall of Technology," through which one would enter the highly flexibile laboratory. The facility would provide areas for problem-solving, designing, computing and prototyping in a motivating, student-friendly environment — at a price tag of $1 million. A consulting group was asked to explore the feasibility of finding funding for the new structure, but in 1992 reported that the community simply could not support so ambitious a project.

Picking up the Pieces

The report was disappointing, but not surprising, considering the local economic climate. In addition, the departure of a key technology teacher, who left to assume an educational leadership role in another community, further hindered progress.

In an effort to assist, the Department of Technology at the University of Southern Maine (USM) helped locate a young, progressive-thinking teacherfor the South Portland School System. Two promising seniors from the Department of Technology were also assigned to do their student teaching at the NETEC site. In addition, USM Department of Technology faculty recommended South Portland technology staff augment their program through:

- appropriate technology learning activities;
- "hands-on/minds-on" experience;
- integrated/interdisciplinary study;
- applied math and science activities;
- development of solutions to the major problems facing humanity — housing, transportation, energy, resource utilization, ecological/-environmental issues, etc.
- study of the place of technology in history;
- computer applications;
- development of life-long learning skills — communication, problem solving, and human relations skills;
- knowledge bases of future careers.

Students would encounter these experiences in an innovative high school program comprised of mini-courses and topics, such as:

- Making Things Work
- [illegible]

Learning Center," was conceived to accommodate activities such as prototyping, modeling, designing, inventing, calculating, testing, manufacturing, and constructing. The Center would consist of three areas, for fabricating, computing, and instruction/planning. Much of the equipment was donated by manufacturers and distributors, both local and national.

The fabricating area ("FAB-LAB," 50' by 23') was designed to house a small milling machine; a variety of hand tools; a selection of power tools from the original shop; an assortment of materials and adhesives; air, water, a jig saw, a band saw, a table saw, a disk belt sander, a grinder, a drill press, a wood lathe, an oven, a strip heater, a metal lathe, small sheet metal equipment, a radial arm saw, and testing meters.

The computing area, 36' by 23,' features magnetic carpet (from Anderson Flooring in South Portland). CenterCore of New England, who design ergonomic office furniture, assisted in this area and donated work stations. This ergonomic furniture will provide modules accommodating discrete learning activities.

Future Directions

In the real world, design is almost never a linear process, as the South Portland NETEC Project has discovered. Basic assumptions about both the curriculum and facility have been challenged and reconsidered. Solving the problems of creating an innovative model program at South Portland has been a group effort of NETEC consultants, the local university, and the business community and must continue. It is an exciting and important process with ultimate impacts on our students' future.

The transition to technology education at South Portland has been greatly enhanced by the generous contributions of many suppliers. But the real keys to change are commitment and a sincere desire to implement a quality program. Our future role in public education hinges upon the profession's progress in this regard.

NORTH COLONIE, NY
Facility Renovation on a Budget

by Thomas Venezio

In 1990 North Colonie Central Schools was invited to participate in the Consortium — not a moment too soon for the technology education staff, who were among the early adopters of the new direction.

The Technology Education program in North Colonie takes place at Shaker High School and Shaker Junior High, which are located on a common school campus. There are four technology educators at Shaker High who teach in six laboratories. They reach about 400 students (approximately 25% of the school population). At Shaker Junior High School, three technology educators teach the entire school population of 750 in three laboratories. With the addition of a new computer space, ten laboratories have been renovated to varying degrees, with the vast majority of work performed by the teachers.

Photo compliments of T. Venezio

Students respond with enthusiasm to the new equipment which replaced outdated machinery at the start of the renovation project.

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THREE-STAGE RENOVATION

A number of strategies for modification evolved. The most profound effect on the appearance of the facilities was accomplished at the least expense.

Stage I: Setting the Tone

Perhaps the most difficult task for technology educators is to part with equipment we no longer use. The North Colonie faculty agonized over each item and finally developed a list of surplus equipment that was put out to bid or be scrapped.

Color schemes were developed for both the junior high and the high school. At the high school, the atmosphere was made clean and bright with a white, tan and maroon-accent scheme. At Shaker Junior High School, a similar approach employed dark and light green and white.

> In *High School: A Report on Secondary Education in America*, Ernest Boyer said, "Technology Education is a basic and fundamental study for all persons, regardless of education or career goal...we recommend that all students study technology."

An effort was made to create specialized areas within each room, conforming to a clear organizational scheme. The various areas focus on testing, modeling, CAD, etc. Technology teacher Jeff Sidor developed a sign format that was attractive and economical to make. It was used throughout the facilities and provides a unifying style throughout the labs.

Stage II: Clean Room/Computer Room

The technology education program at Shaker has become more dependent on computers and computer-controlled equipment. Both the junior and senior high schools needed a clean area for a host of computer activities. At the high school, a recycled storeroom was chosen for the computers, while a finishing room at the junior high school was appropriated for this purpose.

Windows were installed for easy supervision from either adjoining room. A suspended ceiling was added to lower the junior high's twelve foot ceilings. Supplemental electrical outlets were provided. Painting the facilities in a color scheme to match that used in the labs added a finishing touch to the junior high setting. At Shaker High School, a carpet remnant, folding leg tables (approximately $30 each), and computer chairs (approximately $40 each) were acquired to help create a professional atmosphere. The programs' robotics, CNC & CAD equipment, along with the computers, printers and plotters, all call these facilities "home."

> "Perhaps the most difficult task for technology educators is to part with equipment we no longer use."

Stage III: Acquiring Equipment

Acquiring equipment was, without question, the most costly phase of the renovation effort in North Colonie, where a five year equipment replacement plan was underway. The Northeast Consortium grant accelerated this process. A large number of manufacturers donated, loaned or discounted their equipment and supplies in support of the NETEC initiative.

The NETEC effort has provided a needed spark to the critical process of renovation and upgrading. The funding and donations received through the grant, along with considerable elbow grease and imagination, have significantly improved the appearance of the facilities and created a setting that is stimulating and attractive. Students have been excited to see the transformation and use the "new" facilities. These changes, along with the curriculum changes made in previous years, have resulted in a new image for technology education.

■ ■ ■ ■ ■

Thomas Venezio is Supervisor of Home Economics and Technology Education, North Colonie Central Schools, Albany, NY.

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PONAGANSET, RI
Facilities Reflecting the Future

by Michael S. Barnes

Around the country, school systems have begun to incorporate the goals and methodology of technology education. Unfortunately, little curriculum innovation effort is directed to facility design. We work long and hard to provide programs that are educationally sound and essential for all students. Outdated facilities can create a poor public image for technology education. It is demoralizing if, after all our work, visitors bypass our facilities, thinking "oh, this is just a 'shop' class."

The new facilities at Ponaganset have been designed to convey a visual impression of change. The high school and the middle school labs at Ponaganset are white, bright and filled with computers — the word "shop" is the last thing that comes to mind.

Strategies for Change

Facility design and curriculum revision go hand in hand. When selecting new activities one should ask; What space or special equipment will this require? Is my room really set up for problem solving or think tank activities? Is the physical arrangement flexible enough for the various activities I am planning? The answers to these questions will shape the type and placement of furniture, electrical supplies, lighting, color schemes, etc. The ultimate goal should be to design a learning environment.

An important key to technology education is flexibility. At Ponaganset, movable office partitions donated by the local newspaper separate unrelated activities, and two-drawer filing cabinets serve as table bases. Local companies often have surplus office furniture which they may be willing to donate to schools.

The time requirements for this type of facility renovations should not be underestimated. Both faculty and students at Ponaganset invested substantial amounts of time in the planning and remodeling of these labs, resulting in a positive feeling of ownership for all concerned.

New Facilities

The two new Technology Education labs at Ponaganset are located in the same corner of the building as the Math and Science Departments, creating visibility among a wide range of students. We use the display case in the new facility to showcase the students' robotics projects. This display changes daily, chronicling the work in progress and providing effective advertising for the program. A display case should have an electrical outlet and shelves wide enough to hold a computer.

> *"Outdated facilities can create a poor public image for technology education...if, after all our work, visitors bypass our facilities, thinking "oh, this is just a shop class.'"*

The Ponaganset labs share twenty-four computers and are outfitted with new furniture, including bookshelves and magazine racks for reference books and periodicals. These materials are supplemented by computer information and retrieval systems, modems, CD-roms, and cable-TV.

The facilities support the new pre-engineering oriented curriculum, which has a strong problem-solving emphasis. Access to information resources helps students extend their learning beyond the four walls of each room. In addition, the two rooms are designed to facilitate sharing of equipment and talent.

Communications/Engineering

Instruction in Electronics, Lasers, Robotics, Communication Technology, and Satellite Communication is built around two central islands, with four work areas on the perimeter. In the Communication and Engineering (C/E) course students must videotape all completed projects. They periodically present their ideas and models to the class. Their presentations are then viewed on the classroom TV monitor and critiqued.

CAD/Computer Animation, Robotics and Aerospace Engineering

The Ponaganset CAD lab is used for Computer Animation, Robotics and Aerospace Engineering. CAD and Drafting as separate entities. Split-wired duplex outlets are used by the instructor to switch off the monitors in the middle of class, when appropriate, without destroying the students work.

In the Aerospace Engineering program, students develop a self-sustaining Lunar Colony, using computers to generate graphs, AutoCAD drawings, slide shows, simulations, and animations with 3D Studio™ and Animator Pro™. Like the C/E course student presentations and work are videotaped and critiqued. We have a VGA to NTSC converter which we use to display all our computer graphics on the classroom TV Monitor.

Graphic Arts / CAM

Graphic Arts and Computer -Aided Manufacturing are currently housed in the former drafting room. The CAM equipment is the result of donations from four different vendors. Small table top computer-controlled lathes and mills are ideal for a technology education lab.

Manufacturing / Transportation

Although the most traditional of our labs, these rooms are visually striking, clean and bright. All of the machinery can be easily disconnected and pushed to one side for large activities. OSHA-approved rolling bases are available for large equipment. Last year the students designed and built a geodesic shelter with a base twenty feet in diameter. To study manufacturing processes, students con-

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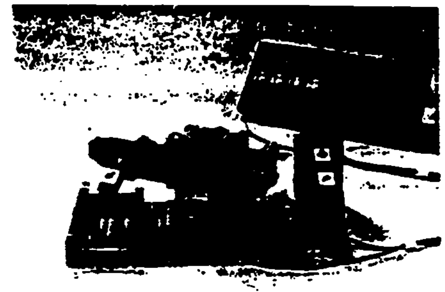
102

centrate on mass production, marketing, and quality control. Transportation students have built solar cars, raced magnetic levitation vehicles, and explored alternate energy sources.

Creating the Right Impression

In our increasingly high tech society, students need to extend their learning beyond the realm of books. Computer storage and retrieval systems, modems, cd-roms, cable-tv, and magazine articles provide informational resources that help round out a technology lab. Tools and equipment are not an end in themselves, but an essential component of any educational system designed for lifelong learning. Curriculum needs must drive the facility design or renovation. Adequate space and appropriate equipment enhance the outcome of any activity, and a renovated facility can help make that very important first impression. ✻



Ponaganset faculty designed Formica-topped lab furniture to provide areas for computation and study.

Desktop video allows students to merge words and images with full-motion video.

Students at Ponaganset High School shape materials with CNC equipment.

Photos compliments of M. Barnes

103